

DECISION RECORD
Environmental Assessment (EA), WY-070-EA14-214
Carrizo Oil & Gas Inc., Mooney Draw 1H, Application for Permit to Drill (APD)
Bureau of Land Management, Buffalo Field Office, Wyoming

DECISION. The BLM approves the application for permit to drill (APD) from Carrizo Oil & Gas Inc. (Carrizo) to drill 1 horizontal oil and gas well and construct the access road and infrastructure as described in the Environmental Assessment, WY-070-EA14-214, both incorporated here by reference.

Compliance. This decision complies with:

- Federal Land Policy and Management Act of 1976 (FLPMA) (43 USC 1701); DOI Order 3310.
- National Environmental Policy Act of 1969 (NEPA) (42 USC 4321).
- National Historic Preservation Act of 1966 (16 USC 470).
- Endangered Species Act of 1974 (16 USC 1531).
- Buffalo & Powder River Basin Final Environmental Impact Statement (FEISs), 1985, 2003 (2011).
- Buffalo Resource Management Plan (RMP) 1985, Amendments 2001, 2003, 2011.

A summary of the details of the approval follows. The EA analysis for the 1 oil and gas well, above, includes the project description, and site-specific mitigation measures which are incorporated by reference in this EA from earlier analysis. The proposed well is 17 miles northwest of Gillette in Campbell County, Wyoming. Carrizo's proposed 1 APD will produce oil and gas from the Muddy Formation of the Powder River Basin (PRB). The well is a horizontal bore proposed in a unitization agreement area and thus the typical 640 acre spacing pattern does not apply.

Approvals: BLM approves the following APD and associated infrastructure:

Well Name/ #	Qtr	Sec	Twp	Rng	Surface Lease
Mooney Draw 1H	SWSW	29	52N	74W	WYW145568

List of Approved Right-of Way.

ROW Grant	ROW Action	Sec	Twp	Rng	Lengths	Width	Surface Disturbance
WYW-168446	Road	23	52N	75W	2,150'	NTE 50'	2.468 acres

Limitations. See conditions of approval (COAs) and see, above, ROW.

THE FINDING OF NO SIGNIFICANT IMPACT (FONSI). The analysis in EA, WY-070-EA14-214 found no significant impact to the human environment and BLM incorporates by reference here that FONSI. Thus an EIS is not required.

Summary of New Information. BLM posted the APD for 30 days and received no public comments. Since BLM received the APD it has not received any new policies appropriate to this proposal.

DECISION RATIONALE. The approval of this project is because:

1. Mitigation measures and COAs analyzed in the EA analysis, in environmental impact statements, or environmental analysis to which are incorporated by reference, will reduce environmental impacts while meeting the BLM's need.
2. The approved project conditioned by its design features and COAs, will not result in any undue or unnecessary environmental degradation. The PRB FEIS analyzed and predicted that the PRB oil and gas development would have significant impacts to the region's GSG population. The impact of this development cumulatively contributes to the potential for local GSG extirpation; yet its effect is

acceptable because it is outside priority habitats and is within the parameters of the PRB FEIS/ROD and current BLM and Wyoming GSG conservation strategies. There are no conflicts anticipated or demonstrated with current uses in the area. This decision approving this APD complies with the Energy Policy Act of 2005, Section 390, 43 CFR 1610.5, 40 CFR 1508.4, and 43 CFR 46.215.

3. To reduce the likelihood of a “take” under the Migratory Bird Treaty Act, BLM sensitive species nesting habitat removal will occur outside of the breeding season or be cleared by survey.
4. Approval of this project conforms to the terms and the conditions of the 1985 Buffalo RMP (BLM 1985) and subsequent update (BLM 2001) and amendments (BLM 2003, 2011). This project complies with the breadth and constraints of the Energy Policy Act of 2005, and subsequent policy.
5. The selected alternative will help meet the nation’s energy need, revenues, and stimulate local economies by maintaining workforces.
6. The operator, in their APD, shall:
 - Comply with all applicable federal, state, and local laws and regulations.
 - Offer water well agreements to the owners of record for permitted water wells within 0.5 mile of a federal producing well in the APD (PRB FEIS ROD, p. 7).
7. The project is clearly lacking in wilderness characteristics because it is amidst mineral development.
8. This decision does not foreclose the lessee or operator to propose a new or supplementary plan for developing the federal oil and gas leases in this project area, including submission of additional APDs to drain minerals in accord with lease rights and law. This decision does not foreclose the lessee or operator to propose using external pumping units via a sundry application process.
9. Carrizo certified it has a surface access agreement with the landowners or it posted a bond.
10. This approval is subject to adherence with all of the operating plans, design features, and mitigation measures contained in the surface use plan of operations and drilling plan information in the individual APD.

ADMINISTRATIVE APPEAL: This decision is subject to administrative appeal in accord with 43 CFR 3165. Request for administrative appeal must include information required under 43 CFR 3165.3(b) (State Director Review), including all supporting documentation. Such a request must be filed in writing with the State Director, Bureau of Land Management, P.O. Box 1828, Cheyenne, Wyoming 82003, no later than 20 business days after this Decision Record is received or considered to have been received. Any party who is adversely affected by the State Director’s decision may appeal that decision to the Interior Board of Land Appeals, as provided in 43 CFR 3165.4.

Field Manager: _____/s/ Duane W. Spencer_____

Date: _____5/30/14_____

FINDING OF NO SIGNIFICANT IMPACT
Environmental Assessment (EA), WY-070-EA14-214
Carrizo Oil & Gas Inc., Mooney Draw 1H, Application for Permit to Drill
Bureau of Land Management, Buffalo Field Office, Wyoming

FINDING OF NO SIGNIFICANT IMPACT (FONSI). Based on the information in the EA, WY-070-EA14-214, which BLM incorporates here by reference; I find that: (1) the implementation of Alternative B (approving 1 application for permit to drill (APD)) will not have significant environmental impacts beyond those addressed in the Buffalo Final Environmental Impact Statement (FEIS) 1985, and the Powder River Basin (PRB) FEIS, 2003, 2011 to which the EA tiers; (2) Alternative B conforms to the Buffalo Field Office (BFO) Resource Management Plan (RMP) (1985, 2001, 2003, 2011); and (3) Alternative B does not constitute a major federal action having a significant effect on the human environment. Thus an EIS is not required. I base this finding on consideration of the Council on Environmental Quality's (CEQ) criteria for significance (40 CFR 1508.27), with regard to the context and to the intensity of the impacts described in the EA, and Interior Department Order 3310.

CONTEXT. Mineral development is a common PRB land use, sourcing over 42% of the nation's coal. The PRB FEIS foreseeable development analyzed the development of 54,200 wells. The additional development analyzed in Alternative B is insignificant in the national, regional, and local context.

INTENSITY. The implementation of Alternative B (as defined above) will result in beneficial effects in the forms of energy and revenue production however; there will also be adverse effects to the environment. Design features and mitigation measures included in Alternative B will minimize adverse environmental effects. The preferred alternative does not pose a significant risk to public health and safety. The geographic area of project does not contain unique characteristics identified in the 1985 RMP, PRB FEIS, or other legislative or regulatory processes. BLM used relevant scientific literature and professional expertise in preparing the EA. The scientific community is reasonably consistent with their conclusions on environmental effects relative to oil and gas development. Research findings on the nature of the environmental effects have minor controversy, are not highly uncertain, or do not involve unique or proven risks. The PRB FEIS predicted and analyzed oil development of the nature proposed with this project and similar projects. The selected alternative does not establish a precedent for future actions with significant effects. The proposal may relate to the PRB Greater Sage-Grouse and its habitat decline having cumulative significant impacts; yet the small size of this project is within the parameters of the impacts in the PRB FEIS. There are no cultural or historical resources present that will be adversely affected by the selected alternative (1 APD approval). The project area is clearly lacking in wilderness characteristics as it is amidst mineral development. No species listed under the Endangered Species Act or their designated critical habitat will be adversely affected. The selected alternative will not have any anticipated effects that would threaten a violation of federal, state, or local law or requirements imposed for the protection of the environment.

ADMINISTRATIVE REVIEW AND APPEAL. This finding is subject to administrative review according to 43 CFR 3165. Request for administrative review of this finding must include information required under 43 CFR 3165.3(b) (State Director Review), including all supporting documentation. Such a request must be filed in writing with the State Director, Bureau of Land Management, P.O. Box 1828, Cheyenne, Wyoming 82003, no later than 20 business days after this FONSI is received or considered to have been received. Parties adversely affected by the State Director's finding may appeal that finding to the Interior Board of Land Appeals, as provided in 43 CFR 3165.4.

Field Manager: /s/ Duane W. Spencer

Date: 5/30/14

ENVIRONMENTAL ASSESSMENT (EA), WY-070-EA14-214
Carrizo Oil & Gas Inc., Mooney Draw 1H, Application for Permit to Drill
Bureau of Land Management, Buffalo Field Office, Wyoming

1. INTRODUCTION

BLM provides an EA for Carrizo Oil & Gas Inc.'s (Carrizo) 1 conventional oil and gas well application for permit to drill (APD), Mooney Draw 1H. BLM's using standard jurisdiction of federal lands: with federal surface over federal minerals. This site-specific analysis tiers into and incorporates by reference the analysis in the Final Environmental Impact Statement and Proposed Plan Amendment for the Powder River Basin Oil and Gas Project (PRB FEIS), WY-070-02-065, 2003, 2011 and the PRB FEIS Record of Decision (ROD) per 40 CFR 1508.28 and 1502.21. One may review these documents at the BLM Buffalo Field Office (BFO) and on our website: http://www.blm.gov/wy/st/en/field_offices/Bufalo.html. The APD is pursuant to the Mineral Leasing Act for the purpose of exploring or developing oil or gas and do not satisfy the categorical exclusion directive of the Energy Policy Act of 2005, Section 390 because the proposed drilling is at a site where no prior drilling over federal lands or federal minerals.

Congress made a 4-part process for federal fluid mineral decisions under the long-term needs of multiple-use. First is the land use / resource management plan (RMP); here the PRB FEIS and ROD amendment to the BFO RMP. Second are the decisions of whether and, if so, under what conditions, to lease lands for fluid mineral development. Courts held leasing decisions are an almost irrevocable resource commitment. Third, (this phase) is deciding on the proposed APD: the site-specific analysis, and mitigation. Fourth is the monitoring and reclamation of wells and their features. (Pendery 2010)

1.1. Background

Carrizo submitted the Mooney Draw 1H as a notice of staking (NOS) to the BFO to produce oil and natural gas from federally managed fluid mineral bearing formations of the PRB, covered by federal and privately owned lands with rolling hills, broad bottom drainages and some steep slopes.

- May 5, 2013: BLM received and posted the Mooney Draw 1H NOS.
- May 23, 2013: BFO assigned the Mooney Draw 1H NOS.
- July 2 and November 13, 2013: BLM conducted onsite inspections to evaluate the proposal and modify it as necessary to alleviate environmental impacts.
- January 10, 2014: Carrizo submitted a Mooney Draw 1H APD to the BFO.
- January 22, 2014: BLM sent Carrizo the post onsite deficiency letter identifying Onshore Oil and Gas Order No. 1 deficiencies for the Mooney Draw 1H.
- March 21, 2014: Carrizo addressed the APD deficiencies.

1.2. Need for the Proposed Project

BLM's need for this project is to determine whether, how, and under what conditions to support the Buffalo Resource Management Plan's (RMP) goals, objectives, and management actions with allowing the exercise of the operator's conditional lease rights to develop fluid minerals on federal leases. BLM incorporates by reference here, the APD information (40 CFR 1502.21). Conditional fluid mineral development supports the RMP and the Mineral Leasing Act of 1920, the Federal Land Policy Management Act (FLPMA), and other laws and regulations.

1.3. Decision to be Made

The BLM will decide whether or not to approve the proposed development, and if so, under what terms and conditions agreeing with the Bureau's multiple use mandate, environmental protection, and RMP.

1.4. Scoping and Issues

BLM posted the proposed APD for 30 days and will timely publish the EA, any finding, and decision on the BFO website. This project is similar in scope to other fluid mineral development the BFO analyzed. External scoping is unlikely to identify new issues, as verified with recent fluid mineral EAs that BLM externally scoped. External scoping of the horizontal drilling in Crazy Cat East EA, WY-070-EA13-028, 2013, in the PRB area received 3 comments, revealing no new issues. The BFO interdisciplinary team (ID team) conducted internal scoping by reviewing the proposed development and project location to identify potentially affected resources and land uses. This EA will not discuss resources and land uses that are either not present, not affected, or that the PRB FEIS adequately addressed. The ID team identified important issues for the affected resources to focus the analysis. This EA addresses the project and its site-specific impacts that were unknown and unavailable for review at the time of the PRB FEIS analysis to help the decision maker come to a reasoned decision. Project issues include:

Air quality	Water quality	Soils and vegetation	Travel management
Wildlife: raptor nesting, migratory birds, special status species			Cultural: National Register eligible sites

2. PROPOSED PROJECT AND ALTERNATIVES

2.1. Alternative A – No Action

The no action alternative would deny the APD requiring the operator to resubmit an APD that complies with statutes and the reasonable measures in the PRB RMP Record of Decision (ROD) in order to lawfully exercise conditional lease rights. The PRB FEIS considered a no action alternative, pp. 2-54 to 2-62. The BLM keeps the no action alternative current using the aggregated effects analysis approach – tiering to or incorporating by reference the analyses and developments approved by the subsequent NEPA analyses for adjacent and intermingled developments to the proposal area; see Table 3.1, below.

2.2. Alternative B Proposed Action (Proposal)

Project Name: Mooney Draw 1H

Overview. Company proposes drilling and developing 1 horizontal oil and gas well into federal mineral estate from 1 new proposed well pad location. The proposed well is 17 miles northwest of Gillette, Campbell County, Wyoming. The primary objective is to drain federal minerals from the Muddy Formation at 9,223 feet total vertical depth. The surface hole, lateral leg, and bottom hole locations are described below in Table 2.1.

Table 2.1. Well Name/#/Lease/Location:

Well Name & Well No.	Qtr	Sec	Twp	Rng	Lease
Mooney Draw 1H	SWSW	29	52N	74W	WYW145568

Table 2.2 List of Approved Right-of Way.

ROW Grant	ROW Action	Sec	Twp	Rng	Lengths	Width	Surface Disturbance
WYW-168446	Road	23	52N	75W	2,150'	NTE 50'	2.468 acres

¹NTE – Not To Exceed

2.2.1. Drilling, Construction and Production Design Features Include:

- Carrizo anticipates completing drilling and construction in 2 years. Drilling and construction is year-round in the region. Weather may cause delays but delays rarely last multiple weeks. Timing limitations in the form of conditions of approval (COAs) and/or agreements with surface owners may impose longer temporal restrictions.
- A road network consisting of 4.4 miles of existing road established for coalbed natural gas (CBNG) development and 1.4 miles of proposed crown and ditch road 50 feet wide across the ditches.

- Existing overhead power line network and 1 new individual power meter.
- Construction of a 100 by 50 by 12 foot deep reserve pit for drilling fluid and cutting containment.
- Hydraulic stimulation using up to 80,000 bbl of water stored likely in 500 bbl hydraulic fracturing (HF) tanks on location for:
 - o storage vessels to heat HF water,
 - o store and mixing of HF chemicals prior to pumping down hole, and
 - o Storage of HF flow back fluids for disposal at an authorized off site facility.
- Potential production facilities including 1 pumping unit, a tank battery, and heater treater and separator units on the well pad and placed on the cut portion of the well location.
- All engines will be equipped with an adequate muffler system, decibel level not to exceed 50 decibels at sensitive receptors (e.g. raptor nests, GSG nesting habitat).

2.2.2. Drilling and Completion Water Sources and Amounts

For a detailed description of design features and construction practices associated with the proposed project, refer to the surface use plan of operations (SUPO) and drilling plan included with the APD. Also see the APD for maps showing the proposed well location and associated facilities described above.

Carrizo estimates that during the drilling phase of the individual well it may use in excess of 80,000 barrels of water for drilling and completion. The operator estimates a 4-6 week period per well. The average daily truck traffic (ADT) for mobilizing the rig to and from the location requires about 40 semi-trucks and 4-6 small trucks per day for 5 days. During drilling operations approximately 2 large trucks (water haulers, cement trucks, etc.) and 4-6 personal pickup trucks per day for 4-6 weeks. During the well completion process (a 1-3 week period per well) the ADT increases to 30 large trucks and 6 personal pickup trucks per day. Finally, during the production phase the ADT will decrease to 1-2 semi-trucks and 1 pickup truck per day. During maintenance operations, 1 workover rig would be needed with 2-3 service trucks daily typically for 5 days or less. BLM incorporated and analyzed the implementation of committed mitigation measures in the SUPO and drilling plan, in addition to the COAs in the PRB FEIS ROD, as well as changes made at the onsite.

Table 2.3. Anticipated Drilling and Completion Sequence and Timing (per well)

Drilling and Completion Step	Approximate Duration
Build location (roads, pad, and other initial infrastructure)	~30 days
Mob rig	5 days ¹
Drilling (24/7)	30-45 days ²
Schedule/logistics for completion	~30 days
Completion (setup, completion, demobilization)	7-21 days
¹ Depending on distance and need to add supplemental drilling equipment, such as skidding plates.	
² By comparison, approximately 2 days are required to drill a CBNG well. Source: ICF 2012	

Table 2.4. Disturbance Summary

Facility	Number or Miles	Disturbance	Interim Disturbance
Engineered Well Pads Mooney Draw 1H	1	4.3 acres	1.5 acres
Proposed Improved Roads Without Utility Corridor	1.3 miles	8.3 acres	5.0 acres
Total Surface Disturbance		12.6 acres	6.5 acres

Additionally, the operator, in their APD, committed to:

- Comply with the approved APD, applicable laws, regulations, orders, and notices to lessees.
- Obtain necessary permits from agencies.

- Offer water well agreements to the owners of record for permitted wells.
- Incorporate measures to alleviate resource impacts in their submitted surface use and drilling plans.
- Certify it has a surface access agreement with the landowners.

The reasonably foreseeable activity within a 4 mile radius (an area of 49,450 acres) of the Mooney Draw 1H well location allows for 620 CBNG wells on 80 acre spacing and 155 conventional oil wells on 320 acres spacing. There are currently 408 existing oil and gas wells within a 4-mile radius of the proposed Mooney Draw 1H well. This includes 401 CBNG wells on 80 acre spacing and 7 conventional oil wells on 320 acres spacing. To date, there are applications for 2 CBNG wells (WOGCC, April 16, 2014).

2.2.3. Off Well Pad

Carrizo will use 4.4 miles of existing crown and ditched access road for its operations. Produced water will be trucked to reinjection and disposal facilities. See p. 7 of the SUPOs for specific details on the Operator's plans for produced water. There are existing gas-gathering facilities in the vicinity of the proposed well. Carrizo did not include plans for gas pipelines with the APD and it is anticipated that those will be submitted under sundry notice at a later date. There is existing 3rd party electrical power overhead lines to the proposed well. The electricity run to the well will be overhead powerlines to the edge of the pad and buried power run to the pumping unit electric motor and other electrically powered devices on site to power the well. Carrizo will propose any alternation to the power route via sundry application or right-of-way application and BLM will analyze such proposal in a separate NEPA analysis. Carrizo does not anticipate requiring the use of generators for this project during initial well production.

2.3. Conformance to the Land Use Plan and Other Environmental Assessments

This proposal does not diverge from the goals and objectives in the Buffalo Resource Management Plan (RMP), 1985, 2001, 2003, 2011, and generally conforms to the terms and conditions of that land use plan, its amendments, supporting FEISs, 1985, 2003 (2011), and laws including the Clean Air Act, 42 USC 7401-7671q (2006), the Clean Water Act, 33 USC 1251 et seq. (1972), etc.

3. AFFECTED ENVIRONMENT

This section briefly describes the physical and regulatory environment that may be significantly affected by the alternatives in Section 2, or where changes in circumstances or regulations occurred since adoption of analyses to which the EA tiers or incorporates by reference; see Table 3.1, below. The PRB FEIS considered a no action alternative (pp. 2-54 to 2-62) in evaluating a development of up to 54,200 fluid mineral wells. Over 60% of the deep oil and gas wells are hydraulically fractured; BLM and Goolsby 2012. The BLM uses the aggregated effects analysis approach incorporating by reference the circumstances and developments approved via the subsequent NEPA analyses (see Table 3.1, below) for adjacent and intermingled developments coincident to proposal area to retain currency in the no action alternative; 615 F. 3d 1122 (9th Cir. 2010). There are 408 producing oil and gas wells within 4-miles of project area, Wyoming Oil and Gas Conservation Commission (WOGCC, April 16, 2014). The total number of conventional wells in the Buffalo planning area is 1313, which includes 783 horizontal wells (federal, fee, and state) (as of April 2013). This represents 41% of the projected 3,200 in the 2003 PRB ROD. (See Table 2.4 for an approximation of the disturbance in the current situation.) This agrees with the PRB FEIS which analyzed the reasonably foreseeable development rolling across the PRB of 51,000 CBNG and 3,200 natural gas and oil wells. The State of Wyoming and BLM also have applications for 2 wells that operators may develop in the near future. In addition, and other operators are likely to continue seeking permits to develop unconnected leases in or in the affects analysis areas near the project area; decisions to approve or deny future proposals will occur following APD submittal. Development occurring on non-federal surface and non-federal mineral estate would continue. The US Geological Survey noted there is only a remote chance of induced seismic activity from the nations hydraulic fracturing and water injection at volumes contemplated in the PRB.

Table 3.1. Overlapping NEPA Analyses by Decision Date; BLM Incorporates Here by Reference

Project / POD Name	NEPA Analysis	Well # / Type	Approval
Federal 20 Mile 225174-2NH	WY-070-EA12-172	1 / Oil	12/2012
Barlow Ranch Federal 074974-3NH well	WY-070-EA12-173	1 / Oil	8/2012
N Shell Draw Add 2	WY-070-EA00-WYW-070-00-049	31 / CBNG	9/2010, 10/2009, 1/2000
W Rough Draw Badger	WY-070-EA05-202	26 / CBNG	8/2005
20 Mile Butte East Add	WY-070-EA03-195, CXWYW145568	4 / CBNG	7/2003, 9/2003
20 Mile Butte East	WY-070-EA03-241, WY-070-CX03-216, WY-070-EA02-289	10 / CBNG	9/2003, 8/2003, 2/2003

See also: SDR WY-2013-005, particularly noting pp. 2-3, incorporating the entirety here by reference.

3.1. Project Area Description

The proposed well, access road, and associated infrastructure has an analysis area of 3,120 acres. Elevations range from 4,400 to 4,750 feet above sea level. Topography ranges from gentle to moderately rugged to rugged with steep slopes and deeply incised draws. The lowlands of the project area consists of rolling hills and broad bottom drainages giving way to dissected uplands with steep down-cut channels. This topography was created predominately by summer thunderstorms and spring runoff in ephemeral drainages with steep gradients and fine sediment substrate, which lead to the Powder River. The project area is drained west to east by Rough and Twenty Mile Creeks. These intermittent streams are tributaries of Wild Horse Creek which drains into the Powder River. Wild Horse Creek's stream banks are vegetated with tree and shrub species consisting of cottonwood tree gallery forest, patches of greasewood, and dense salt cedar. The project area is rangeland that had extensive CBNG development, 2000-2012.

Development potential exists for salable minerals, including sand and gravel deposits and clinker (USDI BLM 2009). Salable minerals are mined from surface deposits and outcrops. Alluvial and colluvial deposits consist of gradational and dissected alluvial fans (USDI BLM 2009). The underlying bedrock in the project area consists entirely of the Wasatch Formation. In the vicinity of the project, the Wasatch Formation is primarily variegated mudstone with sandstone and conglomeratic lenses (Love and Christiansen 1985). The Wasatch Formation is underlain by the Fort Union Formation, which is further subdivided into 3 different members. The upper member of the Fort Union Formation, the Tongue River Member, is known to contain thick, continuous coal beds, including the Anderson-Wyodak coal zone (Bartos and Ogle 2002). The Big George coal seam is considered a deeper equivalent to the Anderson-Wyodak coal zone within the Fort Union Formation (Bartos and Ogle 2002).

3.2. Air Quality

Refer to the PRB FEIS pp. 3-291 to 3-299, for a 2003-era description of the air quality conditions. BLM incorporates by reference, Update of Task 3A Report for the Powder River Basin Coal Review Cumulative Air Quality Effects for 2020, BLM (AECOM), 2009, (Cumulative Air Quality Effects, 2009) as it captures the cumulative air quality effects of present and projected PRB fluid and solid mineral development. The Environmental Protection Agency (EPA) established ozone standards in 2008, finalizing them in 2011. Existing air quality in the PRB is "unclassified/attainment" with all ambient air quality standards. It is also in an area that is in prevention of significant deterioration zone. PRB air quality is a rising concern due to ozone in the oil and gas producing Upper Green River Basin that became 1 of the nation's 40 "nonattainment" zones for ozone in 2012; in addition to PRB-area air quality alerts issued in 2011-2014 for particulate matter (PM), attributed to coal dust. Four sites monitor the air quality in the PRB: Cloud Carrizo in the Bighorn Mountains, Thunder Basin northeast of Gillette,

Campbell County south of Gillette, and Gillette. In addition, the Wyoming Air Resource Monitoring System (WARMS) measures meteorological parameters from 9 sites throughout the State, and particulate concentrations from 5 of those sites, monitors speciated aerosol (3 locations), and evapotranspiration rates (1 location). The sites monitoring air quality for the Powder River Basin are located at Sheridan, South Coal Reservoir, Buffalo, Fortification Creek, and Newcastle. The northeast Wyoming visibility study is ongoing by the Wyoming Department of Environmental Quality (WDEQ). Sites adjacent to the Wyoming PRB-area are at Birney on the Tongue River 24 miles north of the Wyoming-Montana border, Broadus on the Powder River in Montana, and Devils Tower.

Existing air pollutant emission sources in the region include:

- Exhaust emissions (primarily CO and nitrogen oxides (NO_x)) from existing natural gas fired compressor engines used in production of natural gas and CBNG; and, gasoline and diesel vehicle tailpipe emissions of combustion pollutants;
- PM (dust) generated by vehicle travel on unpaved roads, windblown dust from neighboring areas, road sanding during the winter months, coal mines, and trains;
- Transport of air pollutants from emission sources located outside the region;
- NO_x, PM, and other emissions from diesel trains and,
- SO₂ and NO_x from power plants.

3.3. Soils, Ecological Sites, and Vegetation

BLM obtained information on major land resource areas and soil types from the Natural Resources Conservation Service (NRCS) information, including the Land Resource Regions and Major Land Resource Areas of the United States (U.S.), the Caribbean, and the Pacific Basin, U.S. Department of Agriculture (USDA) Handbook 296 (USDA 2006) and the Soil Survey Geographic Database (SSURGO). Soil baseline characterization for the project area is based on SSURGO database review and analyses. SSURGO is the most detailed level of soil mapping done by the USDA NRCS. Soils in the project area were identified from the South Campbell County Survey Area, Wyoming (WY605). The NRCS performed the survey using National Cooperative Soil Survey standards. The BLM uses SSURGO soil survey information to predict soil behavior, limitations, and suitability for a given action. The BLM's long term goal for soil resource management is to maintain, improve, or restore soil health and productivity, and to prevent or minimize soil erosion and compaction. Soil management objectives are to ensure that adequate soil protection is consistent with the resource capabilities.

The project area is in the Southern Part of the Northern Rolling High Plains Major Land Resource Area (MLRA). This area is in the Missouri Plateau, Unglaciaded Section of the Great Plains Province of the Interior Plains. It is an area of old plateaus and terraces that are deeply eroded. Typically, local relief is about 150 to 250 feet. Slopes generally are gently rolling to steep, with wide belts of steeply sloping badlands bordering a few of the larger river valleys. Terraces are common along most of the major river systems in the area. In places, flat-topped, steep-sided buttes rise sharply above the plains.

The dominant soil orders in this MLRA are Aridisols and Entisols. Aridisols are well developed soils that have a very low concentration of organic matter and form in an arid or semi-arid climate. In contrast, Entisols are considered recent soils that lack soil development because erosion or deposition rates occur faster than the rate of soil development. Soils in the project area have developed in alluvium and residuum derived mainly from the Wasatch Formation. Lithology consists of light to dark yellow and tan siltstone and sandstones with minor coal seams. Soils differ with topographic location, slope, and elevation. Soil depths vary from deep in the draw and creek bottoms to shallow in the uplands with very shallow soils on steeper slopes and ridge tops. Topsoil depths that can be salvaged for reclamation range from 0 inches on miscellaneous areas (such as badlands) to 2 inches on ridges and side slopes to in excess of 6 inches in bottomlands. Slopes vary with steep slopes occurring primarily along drainages. The primary soil

limitations in the project area are depth to bedrock, low organic matter content, low water holding capacity, and high water erosion potential.

Soils in the project area were identified from the North Campbell County Survey Area, Wyoming (WY705). The project area has a total of 14 soil map units affected by the proposal. A map unit is the named soils or miscellaneous areas that are dominant or co-dominant in extent. Map units may also have large areas of similar soils or miscellaneous areas not as extensive as the named components, and minor inclusions (dissimilar soils or miscellaneous areas that are minor in extent). The soil series is the most specific category of the national soil classification system, used to designate soil map units. Soil series describe soils that have similar chemistry, physical properties, and perform similarly for land use purposes. Dominant soil map units found in the project area are in Table 3.2. Soil map units representing 1% or greater are identified. Additional soil information is in the Ecological site descriptions. Ecological site descriptions are soil and vegetation community descriptions compiled by the NRCS for the purpose of resource identification providing management and reclamation recommendations (provided below).

Table 3.2. Dominant Soils Affected by the Proposed Action by Map Unit Symbol (MUS)

MUS	Map Unit Name	Acres¹	Project Area
299	Oldwolf-Fairburn loams, 3 to 15% slopes	16.8	1%
132	Deekay-Moorhead loams, 0 to 6% slopes	19.3	1%
335	Wibaux-Shingle-Taluce complex, 6 to 40% slopes	26.7	1%
334	Vonalf-Xema-Mittenbutte fine sandy loams, 3 to 30% slopes	47.9	2%
135	Deekay-Oldwolf loams, 6 to 15% slopes	51.3	2%
168	Jaywest-Spottedhorse loams, 0 to 6% slopes	53.3	2%
134	Deekay-Oldwolf loams, 0 to 6% slopes	53.8	2%
107	Arwite-Vonalf fine sandy loams, 0 to 6% slopes	54.8	2%
105	Arwite-Elwop fine sandy loams, 0 to 6% slopes	66.9	2%
285	Haverdad-Boruff complex, 0 to 3% slopes, occasionally flooded	105.3	3%
253	Absted-Arvada-Slickspots complex, 0 to 6% slopes	116.9	4%
239	Ironbutte-Fairburn-Mittenbutte complex, 6 to 40% slopes	125.6	4%
278	Fairburn-Samsil-Badland complex, 10 to 45% slopes	606.1	19%
225	Ucross-Iwait-Fairburn loams, 3 to 30% slopes	1,756.2	56%
Total Acres		3,120.3	100%

¹ The dominant soils are soil types that cover at least 1 percent or more of the project area. NRCS 2010.

Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to a taxonomic class other than those of the major soils. Minor components may have properties and behavioral characteristics divergent enough to affect use or to require different management. Areas of minor components were identified during the onsite investigations especially where the soil pattern was so complex that it was impractical to identify all the soils and miscellaneous areas on the landscape.

3.3.1. Soils Susceptible to Erosion

Productivity loss is likely to occur on most disturbed soils if erosion is not mitigated. The development of a favorable rooting zone by the weathering of parent rock is much slower than development of the surface horizon. One estimate of this renewal rate is 0.5 tons per acre per year for unconsolidated parent materials and much less for consolidated materials. Loss of organic matter, resulting from erosion and tillage, is one of the primary causes for reduction in production yields. As organic matter decreases, soil aggregate stability, soil moisture holding capacity, and cation exchange capacity decline (USDA 1998). The NRSC (2010) soil interpretations show that some area soils are highly susceptibility to water and wind erosion.

This includes the Fairburn-Samsil-Badland complex, 10 to 45% slopes and Wibaux-Shingle-Taluce complex, 6 to 40% slopes. Even though most soils in the project area are not highly susceptible to erosion in the undisturbed state, the sub-soils that will be exposed from construction are. Drastically disturbed site such as well pads create an environment that is highly susceptibility to water and wind erosion.

3.3.2. Reclamation Suitability (Source Material)

The 2 map units that are made up of the soils with most limiting chemical and physical soil properties make up about 20% of the project area and include the Fairburn-Samsil-Badland complex, 10 to 45% slopes and Wibaux-Shingle-Taluce complex, 6 to 40% slopes. Fortunately, most the surface disturbance will not impact these soils. The majority of the surface disturbance is proposed over 4 map units including Ucross-Iwait-Fairburn loams, Ironbutte-Fairburn-Mittenbutte complex, Arwite-Elwop fine sandy loams and Deekay-Oldwolf loams. The dominant components of these soils have a fair to poor rating as a source of topsoil or reclamation material due to shallow depth the bed rock, low organic matter content, doughiness, and susceptibility to water erosion.

3.4. Ecological Site and Vegetation

The well location is in the Campbell County North (705) soil Survey Area. Ecological site descriptions provide site and vegetation information needed for resource identification, management, and reclamation recommendations. To determine the appropriate ecological sites for the proposal area, BLM analyzed data from on-site inspections and from NRCS published soil surveys. A summary of the proposal's ecological sites and their corresponding map units are in Table 3.3. The onsite inspection confirmed the Sandy-Loamy Ecosite composition with a vegetative community dominated by western wheat grass, sandberg bluegrass, prairie junegrass, needleandthread, blue gramma threadleaf sedge, prairie sandreed, little blue stem, Indian rice grass, and cheatgrass with a health big sagebrush/silver sagebrush component in the area. Sagebrush canopy cover ranges from 0-5% with an average height of 10-20 inches. The minor species present include yarrow, green rabbit brush, plains prickly pear, yucca, and scarlet globemallow.

Table 3.3. Ecological Sites and Soils Map Unit Symbols (MUS) within the Project Area

MUS	Ecological Site	Acres	Project Area
253	Loamy (10-14NP) Loamy (15-17NP)	2,072.1	66.4%
299			
132			
135			
168			
134			
225			
334	Sandy (15-17NP)	169.7	5.4%
107			
105			
335	Shallow Loamy (10-14 NP) Shallow Loamy (15-17 NP)	758.4	24.3%
239			
278			
285	Lowland (10-14 N)	105.3	3.4%

3.5. Water Resources

WDEQ regulates Wyoming's water quality with EPA oversight. Carrizo will truck water to the location for drilling and HF operations. Carrizo is proposing to obtain drilling and HF water by trucking water from Dead Horse Load located NESW Section 15, T49N/R77W. Refer to the wells specific SUPO, p.5, for the location of the water source and transportation routes. Carrizo estimates the volume to of water needed for drilling at 7,000bbls and well completion at 80,000 bbls with water will be stored on location

in a temporary storage tank. During the initial phase of well production the produced oil and water will be stored in tanks and then periodically transported by truck off location. The operator disclosed the disposal methods but p. 7 of the SUPO states that drilling fluids will be taken to 1 of 3 approved Class II disposal wells or/and an evaporation facility.

3.5.1. Groundwater

The area's historical use of groundwater was for stock or domestic water. There are 408 oil and gas wells in a 1-mile radius of the proposed well. A search of the WSEO Ground Water Rights Database showed 1 registered stock water well within 1 mile of the proposed well with depth of 705 feet. The Fox Hills, the deepest penetrated fresh water zone in the PRB, is 5,221 to 5,295 feet deep at the Mooney Draw 1H well location. Refer to the PRB FEIS for additional information on groundwater, pp. 3-1 to 3-36. The 2004 EPA study found it unlikely that hydraulically fractured CBNG wells would contaminate ground water. The EPA has an expansive, on-going study looking at more HF aspects and has yet to issue findings. A 2011-2012 Geological Survey study found no groundwater effects from thousands of deep HF oil and gas wells. Adgate, 2014, Warner 2012, and news sources reveal a minor controversy over a state's non-disclosure of proprietary HF fluids while release decisions receive administrative and court reviews.

3.5.2. Surface Water

The project area is in the Twenty Mile Creek and Rough Draw drainages - tributaries to the Wild Horse Creek which is tributary to the Upper Powder River. Most of the area drainages are ephemeral (flowing only in response to a precipitation event or snow melt) to intermittent (flowing only at certain times of the year when it receives water from alluvial groundwater, springs, or other surface source). The channels range from primarily well vegetated grassy swales, without defined bed and bank to steeply incised draws. See the PRB FEIS for a surface water quality discussion, pp. 3-48 to 3-49.

3.6. Wetlands/Riparian

Wild Horse Creek and 7 stock ponds in the project area are included in the National Wetlands Index listed as freshwater emergent wetlands. The proposed well and access road do not impact this stream channel, however, there is the potential that gas and/or oil pipelines constructed by '3d party' operators could directly impact wetlands. Other ephemeral drainages, which flow into intermittently, dissect the area. The ephemeral drainages have gentle slope with vegetated bottoms with numerous small head-cut features.

3.7. Invasive or Noxious Species

BLM discovered no state-listed noxious weed in the project area by a search of inventory maps and/or databases. However, salt cedar (*T. ramosissima*), a state-listed noxious weed, was observed along Wild Horse Creek during subsequent field investigations. Gelbhard, 2003 and Duniway, 2010, showed that surface disturbances increase the proliferation of invasive or noxious species out to 0.5 miles or more from the disturbance while correspondingly compromising native communities in the same footprint. Cheatgrass (*Bromus tectorum*) and to a lesser extent, Japanese brome (*B. japonicus*) exist in the affected environment. Foxtail brome also inundates the creek bottom along Wild Horse Creek. These species are found in high densities and numerous locations throughout NE Wyoming. Balch, 2013, linked the proliferation of cheatgrass in semi-arid environments to the increased frequency and severity of wildfire.

3.8. Fish and Wildlife

The PRB FEIS identified wildlife species occurring in the PRB, pp. 3-113 to 3-206. Carrizo employed Wildlife Resources, LLC to complete wildlife surveys and habitat assessment within 0.5 miles of the project area. Likewise, the BLM wildlife biologists performed a habitat assessment in the project area during the onsite inspections. The biologist evaluated impacts to wildlife resources and recommended project modifications where wildlife issues arose. BLM wildlife biologists also consulted databases compiled and managed by BLM BFO wildlife staff, the PRB FEIS, Wyoming Game and Fish Department (WGFD) datasets, and the Wyoming Natural Diversity Database (WYNDD) to evaluate the affected

environment for wildlife species that may occur in the project area. Livestock grazing (sheep and cattle) and mineral development are the predominant land uses in the area. The rangeland at the well location and the immediate area has been intensively grazed leaving the area with sage brush cover that ranges from sparse with standing vegetation to dense in small patches with good understory. In general, the area habitat is rolling hills of grassland with a healthy sage brush component. Several rock outcroppings and cliff banks were surveyed during the habitat assessment.

3.8.1. Big Game

The big game species occurring in the project area are elk, mule deer, pronghorn, and white-tailed deer. Yearlong use is when a population of animals makes general use of suitable documented habitat sites in the range on a year-round basis. Animals may leave the area under severe conditions. Winter-yearlong use is when a population or a portion of a population of animals makes general use of the documented suitable habitat sites in this range on a year-round basis, but during the winter months there is a significant influx of additional animals into the area from other seasonal ranges. The project is in the range of the Powder River (# 319) mule deer and (#303) white-tail deer and Gillette (#351) pronghorn herds. The mule deer herd was 32% below the population objective in 2012 (WGFD 2013a). The herd declined 19% since 2007 falling below population objectives for the past 16 years. The white-tailed deer herd, also declining, was still more than 100% above objective and has been above objectives for the past 12 years. The pronghorn herd was 6% below population objectives and has been for the past 2 years. The PRB FEIS discussed the affected environment for pronghorn, mule deer, and white-tailed deer on pp. 3-117 to 3-122, pp. 3-127 to 3-132, and 3-122 to 3-127 respectively. The elk population is this hunt unit, 129, is currently not managed.

3.8.2. Raptors

The PRB FEIS discussed the affected environment for raptors, pp. 3-141 to 3-148. There 18 are known raptor nests within 0.5 miles of the proposed well site. Wildlife Resources completed surveys between April 15 and June 15, 2013 to search for undocumented raptor nests with special attention given to rock outcrops, cliffs, ridges knolls and other likely areas. However not all of the project area was included in their survey and only 5 nests in the project area were reported. None of the 5 nests surveyed by Wildlife Resources 2014 were active during their surveys. The other 13 nest were not surveyed in 2014; it is assumed that some are active in 2014. No new nests were observed in the area Wildlife Resources surveyed. Raptor nesting habitat is present thought out the area an unidentified raptors in flight were noted by the BLM during the onsite inspection.

3.8.3. Plains Sharp tailed Grouse

The PRB FEIS discussed the affected environment for plains sharp-tailed grouse on pp. 3-148 to 3-150. Sharp-tailed grouse inhabit short and mixed-grass prairie, sagebrush shrublands, woodland edges, and river canyons. In Wyoming, this species is found where grasslands are intermixed with shrublands, especially wooded draws, shrubby riparian areas, and wet meadows. Habitats in the project area have potential to support sharp-tailed grouse. The mosaic of grasslands and sagebrush-grasslands that occur in the area may provide nesting and brood-rearing habitat, but limited availability of berry producing shrubs limit the likelihood of plains sharp-tailed grouse occurrence. The nearest known plains sharp-tailed grouse leks are approximately 0.25 of the existing access road and 0.43 miles of the proposed well pad. BLM did not observe sharp-tailed grouse during the onsite inspections. Wildlife Resources reported 3 individual sharp-tail leks in the vicinity of the project area that were not in BLM or WGFD databases.

3.8.4. Migratory Birds

The PRB FEIS discussed the affected environment for migratory birds, pp. 3-150 to 3-153. The affected environment of this project for migratory birds is similar to that analyzed in the Sahara POD EA pp. 16-17, incorporated here by reference. Several migratory species are also BLM special status (sensitive)

species (SSS). Those suspected of occurring in the project area include Baird's sparrow, Brewer's sparrow, ferruginous hawk, loggerhead shrike, sage sparrow and sage thrasher.

3.8.5. Threatened, Endangered, Candidate, Special Status (Sensitive) Species

Project effects will not impact threatened, endangered, candidate, and proposed species occurring in the area beyond the level analyzed in the PRB FEIS. A discussion of the affected environment is in the PRB FEIS, pp. 3-174 to 3-179. A description of habitat and presence for threatened and endangered species is in Table 4.3, in Section 4.9.5 below. Ute ladies'-tresses orchid (ULT) habitat is not present in the project area and the species is not expected to occur.

3.8.5.1. Ute Ladies'-Tresses Orchid (ULT)

The project area was surveyed by Wildlife Resources in 2014 for ULT as a listed species under the Endangered Species Act (ESA). Suitable habitat or individuals was not present. Soil types along the creek drainage bottoms have soils with moderately high clay content and are alkaline. No populations of the ULT are present in Campbell County. The closest known population is near Wind Creek in Converse County, 16 miles southwest. The nearest known suitable habitat for ULT is 4 miles to the southeast.

3.8.5.2. Candidate Species - Greater Sage-Grouse (GSG)

The PRB FEIS has a detailed discussion on GSG ecology and habitat, pp. 3-194 to 3-199. The affected environment of this project for GSG is similar to that analyzed in the Sahara POD EA pp. 18-19, incorporated here by reference. The 20 Mile Lek is in the project area only 0.25 miles from the existing crown and ditched road that will be widened and resurfaced, 0.92 miles from the proposed new access road, and 2.2 miles from the 20 Mile Lek. The Mooney Draw 1H well is 19 miles west of GSG priority habitat, as identified in EO 2011-5, Greater Sage-grouse Core Area Protection. GSG habitat models indicate that the project area may contain high quality GSG nesting habitat (Walker et al. 2007). The BLM confirmed suitable nesting and brood rearing habitat exists throughout the area surrounding the new well site and access road which has been modeled and mapped.

3.8.5.3. Special Status (Sensitive) Species (SSS)

The PRB FEIS analyzed SSS, pp. 3-189 to 3-201. Wyoming BLM manages habitats for SSS and Species of Concern to preclude listings as threatened or endangered species. The authority for the SSS policy comes from the Endangered Species Act (ESA) of 1973, as amended; the FLPMA of 1976; the U.S. Department of the Interior (USDI) Manual 235.1.1A, and BLM Manual 6840. The policy goals are to: maintain vulnerable species and habitat components in functional BLM ecosystems; ensure SSS are considered in land management decisions; prevent a need for species listing under the ESA; and prioritize needed conservation work with an emphasis on habitat. Only potentially affected species are discussed below. Evaluations of area Wyoming BLM SSS are in Appendix A of this EA. For the species listed below, where habitat is present but there were no recorded observations, surveys specifically targeting these species were not conducted unless otherwise stated. Some may be present, but are unrecorded, and others likely are not present. See also, the SSS table in Appendix A of the administrative record.

3.8.5.3.1. Black-tailed Prairie Dog

The PRB FEIS discussed the affected environment for black-tailed prairie dogs, p. 3-179. The black-tailed prairie dog was on the list of candidate species for federal listing in 2000 (FWS 2000). It was removed from the list in 2004. Comparisons with 1994 aerial imagery indicated that black-tailed prairie dog acreage remained stable from 1994 to 2001, but aerial surveys in 2003 indicated that approximately 47% of the prairie dog acreage was impacted by Sylvatic plague and/or control efforts (Grenier et al. 2004). Due to human-caused factors, black-tailed prairie dog populations are now highly fragmented and isolated (Miller et al. 1994). Most colonies are small and subject to potential extirpation due to inbreeding, population fluctuations, and other problems that affect long term population viability, such as landowner poisoning and disease (Primack 1993, Meffe and Carroll 1994, Noss and Cooperrider 1994).

Records show 2 small black-tailed prairie dog colonies in the project area. Wildlife resources surveyed the colony at SENE Section 25 southwest of the existing access road and there is another adjacent to the existing access road location SWSW section 26, T52n/R75W.

3.8.5.3.2. Bald Eagle

The PRB FEIS discussed the affected environment for bald eagles, p. 3-175. The bald eagle was a threatened species when BLM approved the PRB FEIS. FWS removed the bald eagle from the ESA in 2007. The bald eagle has protection under the Bald and Golden Eagle Protection and the Migratory Bird Treaty Acts. Mature cottonwoods are prolific along Wild Horse Creek nearly 3 miles southwest of the Mooney Draw 1H well but the existing access road crosses through this roosting and nesting habitat in Section 34, T52N/R75W. Wildlife Resources did not survey for roosting bald eagles within 1 mile of the project area during winter roost surveys (Wildlife Resources 2014). Surveys from 2007-2011 reported roosting bald eagles in the project area vicinity - the nearest were a mile away, in January 2007.

3.8.5.3.3. Ferruginous Hawk

The PRB FEIS discussed the affected environment for ferruginous hawk, p. 3-183. The species is widely distributed; its population status and trends are unknown but are suspected as stable. Populations are experiencing habitat loss, and they are sensitive to human disturbance. In the PRB, this hawk inhabits grasslands and sage shrublands. They typically nest on the ground, increasing its exposure to ground predators. Suitable foraging habitat and nesting sites for the ferruginous hawk are present throughout the project area however there are no known ferruginous hawk nests in 1 mile of the project area.

3.8.5.3.4. Western Burrowing Owl

The PRB FEIS discussed the affected environment for the Western burrowing owl (burrowing owl), p. 3-186. Current population estimates for the U.S. are not well known but trend data suggest declines throughout the burrowing owls' North American range (McDonald et al. 2004). Primary threats are habitat loss and fragmentation, mostly due to intensive agricultural and urban development and habitat degradation, due to declines in populations of colonial burrowing mammals (Klute et al. 2003). Historic survey information at the BFO indicates there are no burrowing owl nests within 0.25 mile of the project area. Wildlife Resources did not observe any burrowing owls during raptor surveys or when surveying the black-tailed prairie dog colony. The 2 black-tailed prairie dog colonies in the project area confirm the presence suitable western burrowing owl habitat in the project area; see Appendix B, Table B.1.

3.8.5.3.5. Mountain Plover

The PRB FEIS discussed the affected environment for mountain plover on pp. 3-177 to 3-178. FWS proposed the mountain plover as a threatened species under the ESA when the PRB EIS was written. FWS withdrew the proposal in 2011. Suitable habitat for mountain plover in the project area is limited and they typically seek out large prairie dog colonies (10 or more acres). Surveys for nesting mountain plovers were not conducted by Wildlife Resources in 2014 as they determined that the project area does not have habitat requirements for the species. No suitable mountain plover habitat, individuals or nests were observed by the BLM biologist during field visits.

3.8.5.3.6. Brewer's Sparrow

The PRB FEIS discussed the affected environment for Brewer's sparrow, p. 3-200. Sagebrush grassland areas in the project area provide suitable nesting habitat, and the species is suspected to occur.

3.8.5.3.7. Northern Leopard Frog

The affected environment for northern leopard frog is discussed in the PRB FEIS on p. 3-181. Suitable habitat is present along Wild Horse Creek and tributaries as well as the 25 stock reservoirs and within the wetland and riparian areas of the project area. There are no recorded surveys for northern leopard frogs in the project area, but it is suspected to be present.

3.9. Cultural Resources

Per Section 106 of the National Historic Preservation Act, BLM must consider impacts to historic properties (sites that are eligible for or listed on the National Register of Historic Places (NRHP)). For an overview of cultural resources found in the area, refer to the Draft Cultural Class I Regional Overview, Buffalo Field Office (BLM, 2010). A Class III (intensive) cultural resource inventory (BFO project no. 70140032) was performed to locate specific historic properties which may be impacted by the proposal. The following resources are in or near the proposal area.

Table 3.5. Area Cultural Resources & National Register of Historic Places (NRHP Eligibility

Site #	Site Type	NRHP Eligibility	Site #	Site Type	NRHP Eligibility
48CA265	Historic Railroad	Eligible	48CA5212	Historic Echeta Reservoir	Eligible
48CA3047	Historic & Prehistoric Site	Not Eligible	48CA5305	Historic Site	Not Eligible
48CA3070	Historic Site	Not Eligible	48CA7189	Historic Site	Not Eligible
48CA5044	Prehistoric Site	Not Eligible			

Sites 48CA265 (historic Chicago, Burlington and Quincy Railroad), and 48CA5212 (historic Echeta Reservoir) are eligible for the NRHP. Contributing portions of 48CA265 (typically expressed as culverts) are present in the project area. None of the contributing portions of the site retain their integrity of setting due to modern additions to the landscape including CBNG wells, upgraded roads, railroad maintenance, pipelines, reservoirs, POD buildings, compressor stations, etc. Site 48CA5212 is near the project area and retains integrity of setting, yet the topography masks the proposed well and access road from the site.

3.10. Transportation

The main access to the proposed well is off of Campbell County Road (CCR) 17-29 (Echeta Road). There is 4.4 miles of existing crown and ditched access road constructed road CBNG development including 1 existing 48 inch diameter culvert crossing of Wild Horse Creek and a low water crossing of Rough Draw that Carrizo proposes to use for well access. The existing road is used for ranching and to a lesser degree recreational hunting. This existing road will need improvements for conventional oil well development including the addition of turnouts, curve widening and resurfacing to meet BLM's 9113 road standards. The general condition is poor due to a combination of poor construction material available and the lack of maintenance. The crown and ditch road has a travel way width averaging 16 feet with surfaced with clinker and a sub-grade of 20 feet. Where slope and grade are minimal (less than 15% slope and 7% grade), the ditches are well vegetated they are approximately 6 inches deep with some visible scouring. Ditches on steep slopes and grade (16% slope and 8% grade or greater) are typically not well vegetated, erosion is occurring and scouring exceeds 6 inches. There are several spots where rutting greater than 4 inches has occurred on the running surface due to minimal compaction and minimal drainage control. There is 1 low water crossing and a number of 18 inch corrugated metal culverts; they are in poor condition, requiring maintenance to clean them out. The 2.4 miles of the road has grades 10-16%.

The two main secondary road surfacing materials used in the PRB are crushed aggregate and clinker (scoria). Crushed aggregate, often referred to as gravel, is a hard / durable material made from crushed granite or limestone typically 0.75 inch or less for road bed construction. One cubic yard of gravel weighs around 3,000 pounds. Clinker rock is a red-brown shale that was baked and fused by in situ burning of underlying coal. Clinker found in the PRB (called porcelanite) has similar properties to ceramic; it readily breaks into smaller, sharp-edged fragments. Its weight varies depending upon the parent material but it usually light, having a specific gravity greater than one. Trucking costs are high and on the increase in the region and is the greatest factor affecting the cost of surfacing material. Typically clinker costs less than gravel however the frequency that clinker must be replaced to maintain adequate road surface drives the overall cost up as trucking fees add up.

4. ENVIRONMENTAL EFFECTS

This section describes the environmental effects of Alternatives A and B. This analysis addresses the direct and indirect effects of implementing the proposed wells, the cumulative effects of the proposed wells, combined with reasonably foreseeable federal and non-federal actions, identifies and analyzes mitigation measures (COAs), and discloses any residual effects remaining, following mitigation.

4.1. No Action Alternative.

BLM analyzed the no action alternative as Alternative 3 in the PRB FEIS and it subsequently received augmentation of the effects analysis in this EA through the analysis of mineral projects, their approval, and construction; and through the analysis and approval of other projects. BLM incorporates by reference these analyses in this EA; see Table 3.1 above. This updated the no action alternative and cumulative effects. The project area has about 86.6 acres of surface disturbance from existing roads, well pads, and oil and gas facilities. Under the no action alternative, on-going well field operations would continue with the development of single and multi-well pads as they are approved by the WOGCC. The production and the drilling and completion of these new wells would result in noise and human presence that could affect resources in the project area; these effects could include the disruption of wildlife, the dispersal of noxious and invasive weed species, and dust effects from traffic on unpaved roads. Present fluid mineral development in the PRB is under half of that envisioned and analyzed in the PRB FEIS. There is only a remote potential for significant effects above those identified in the PRB FEIS to resource issues as a result of implementing the no action alternative.

4.2. Alternative B, Proposed Action (Proposal)

This analysis presumes Carrizo and BLM enforce the APDs' drilling plan, plan of development, and Onshore Oil and Gas Order No.'s 2 and 7. Short-term direct effects (2 years or less) will exist for land uses within or adjacent to the project area due to construction activities, including surface disturbance, dust generation, and noise associated with heavy equipment operation. Construction, initial operation, and well servicing and maintenance would likely displace wildlife. Consequently, this would reduce the success of big game hunting in the area. Likewise, livestock grazing would be reduced impacting the success of stock growers' operations. These effects would continue until drilling and construction activities are complete, interim reclamation and stabilization measures achieve a steady state, and well visitation and generator refueling is minimized.

Interim reclamation is proposed to revegetate portions of the well pads, and access roads no longer needed after construction. Project impacts that will be long term (greater than 2 years) result from the use of pad and road needed for operations and maintenance for the life of the project (approximately 30-50 years). It is anticipated that these lands would not be available for wildlife or livestock grazing or other land uses during that time. Land use at the well site and along the access road and utility corridors would be converted for the duration of the well operation (and until final reclamation is achieved) to a mineral development. During this timeframe, the proposed lands would offer marginal if any grazing potential. Cumulative effects to land uses from oil and gas development are discussed in the PRB FEIS, pp. 4-298 and 4-107 to 4-129.

4.2.1. Air Quality

In the project area, air quality impacts would occur during construction (due to surface disturbance by earth-moving equipment, vehicle traffic fugitive dust, well testing, as well as drilling rig and vehicle engine exhaust) and production (including well production equipment, booster and pipeline compression engine exhaust). The amount of air pollutant emissions during construction would be controlled by watering disturbed soils, and by air pollutant emission limitations imposed by applicable air quality regulatory agencies. BLM incorporates by reference the analysis found in the August 2012 Lease Sale EA, WY-070-EA12-44, pp. 45-51 (air quality, greenhouse gas emissions, and visibility). Air quality

impacts modeled in the PRB FEIS and Cumulative Air Quality Effects, 2009 concluded that PRB projected fluid and solid development would not violate state, tribal, or federal air quality standards and this project is well within the projected development parameters.

4.2.2. Soils, Ecological Sites, and Vegetation

4.2.2.1. Direct and Indirect Effects

The PRB FEIS analyzed direct and indirect impacts to soils associated with fluid mineral development. For these affects refer to p. 4-134 of the PRB EIS.

4.2.2.1.1. Constructed Well Pad

The greatest impacts to the soil resources associated with this project include the area of the well pad, depth of excavation and the large amount of soil drastically disturbed during the construction of the well pad. Well pads, constructed to facilitate horizontal well drilling and HF operations are exceedingly large to accommodate onsite water storage that may exceed 80,000 bbls as well as many semi-trucks and other support equipment associated with a single HF operation. Initial pad size is reduced per APD through interim reclamation and, if the well produces, the industry practice is drilling multiple wells from 1 pad. It can cost \$7-10 million per well so prudent economics require a company to find a proven producer prior to designing and drilling new wells from the pad. Of course the drilling of additional wells from the pad drives down the average well surface disturbance; and if the first well is unsuccessful then reclamation accounts for the entire surface disturbance. The other unanticipated impact associated with HF involves the amount of large truck traffic (between 200 and 700 trucks/well) to transport water storage containers, water and other HF materials to the location as well as truck traffic anticipated for removing the storage tanks and flow-back fluid from the completion.

Anticipated impacts occurring include soil rutting and mixing, compaction, increased erosion potential, and loss of soil productivity. The most notable impacts would occur in association with the construction of well pads, staging areas, and roads. Construction of these facilities requires grading and leveling, with the greatest level of effort required on more steeply sloping areas. Construction activities mix the soil profiles with a corresponding loss of soil structure. Mixing may result in removal, dilution, or relocation of organic matter and nutrients to depths where it would be unavailable for vegetative use. Less desirable inorganic compounds such as carbonates, salts, or weathered materials could be relocated and have a negative impact on revegetation.

Rutting affects the surface hydrology of a site as well as the rooting environment. The process of rutting physically severs roots, thus reducing soil aeration and infiltration thereby degrading the rooting environment. Rutting may result in topsoil and subsoil mixing, thereby reducing soil productivity. Rutting also disrupts natural surface water hydrology by diverting and concentrating water flow thus accelerating erosion. Soil mixing typically results in a decrease in soil fertility and a disruption of soil structure.

Soils compaction results from the construction of wells and associated facilities, continued vehicle and foot traffic as well as operational activities. Factors affecting compaction include soil texture, moisture, organic matter, clay content and type, pressure exerted, and the number of passes by vehicle traffic or machinery. Compaction leads to a loss of soil structure; decreased infiltration, permeability, and soil aeration; as well as increased runoff and erosion. Increased erosion can lead to a decrease in soil fertility and an increase in sedimentation. The duration and intensity of these impacts would vary according to the type of construction activity to be completed and the inherent characteristics of the soils to be impacted.

The potential for erosion would increase through the loss of vegetation cover and soil structure as compared to an undisturbed state. Soil productivity would decrease, primarily as a result of profile mixing and compaction along with the loss in vegetative cover. These impacts would begin immediately as the soils would be subjected to grading and construction activities and impacts would continue for the term of

operations. The impacts on soils would move to a steady state as construction activities were completed and well production/maintenance operations begin.

An important component of soils in Wyoming's semiarid rangelands, especially in the Wyoming big sagebrush cover type, are biological soil crusts, or cryptogamic soils that occupy ground area not covered with vascular plants. Biological soil crusts are important in maintaining soil stability, controlling erosion, fixing nitrogen, providing nutrients to vascular plants, increasing precipitation infiltration rates, and providing suitable seed beds (Belnap et al. 2001). They are adapted to growing in severe climates; however, they take many years to develop (20 to 100) and can be easily damaged or destroyed by surface disturbances associated with construction activities. These impacts, singly or in combination, could increase the potential for valuable soil loss, reduction in soil quality, invasive/noxious/poisonous plant spread, invasion and establishment, and increased sedimentation and salt loads to the watershed system, if applicable mitigation measures are not used.

4.2.2.1.2. Pad Construction: Open Reserve Pit vs. Closed Loop Drilling System

It is the Carrizo's intent to drill the Mooney Draw 1H using an open reserve pit excavated on location. Drilling fluid and drill cuttings would be caught and disposed of on location in the reserve pit 50 feet by 100 and 12 feet deep. Carrizo's SUPO for the APD and associated well pad diagrams included plans for managing drilling fluid. Following drilling operations, pits will be allowed to dry sufficiently prior to back filling and will be closed as soon as possible.

The material excavated from the reserve pits is calculated to be approximately 1200 cubic yards of spoil material (substratum not soil) that will need to be stored on the surface until the pit is closed. Cuttings contained in the pit will total approximately 1,005 cubic yards and in addition to 4,300 barrels of drilling fluid. Once the pits are sufficiently dried, they will be backfilled with the spoil material however the volume of cuttings captured in the pits will displace spoil material from being returned into the excavated pit. An alternate option for managing drilling mud and BLM's preference would be using a closed loop system. This alternative is consistent with Wyoming BLM's Instruction Memorandum No. WY-2012-007, 2011, incorporated here by reference. BLM recommended this option to Carrizo but the Operator chose not to pursue it. Use of enclosed tanks and closed loop or semi-closed loop systems is environmentally preferable to the use of open pits and is encouraged by the BLM.

Open production pits are strongly discouraged by BLM. Closed tanks and systems minimize waste, entry by wildlife, fugitive emissions that affect air quality, and reduce the risk of soil and groundwater contamination. In addition, the use of tanks instead of large open reserve pits expedites the ability to complete interim reclamation. Costs may be reduced with the use of tanks, particularly when the pit requires solidification or netting.

With a closed loop drilling system, drilling water would be typically be stored on location in 3, 500bbl tanks and drilling fluid would be stored in 2, 500bbl "mud" tanks. A "shaker" separates the drill cuttings from the drilling fluid which are removed to a, lined bermed containment area on location. Minimal additional excavation is required to construct the containment areas. After the well is drilled and completed, the dried cuttings would be either be buried on location or disposed of at an authorized facility. Drilling fluids would be disposed of at an authorized facility or location. Carrizo anticipates 6 months for the pits to dry naturally. BLM's will require reserve pits to be closed as soon as practical but no later than 6 months after the well is completed. Fluids remaining in the reserve pit may need to be removed by the Operator and disposed of at a permitted facility to accommodate this timeframe.

4.2.2.1.3. Access Road

There is increased soil disturbance associated with construction and/or upgrade of roads with running surface 16 feet and a 20 foot sub grade greatly increasing the soil disturbance depending on site

topography. Geomorphic effects of roads and other surface disturbance range from chronic and long-term contributions of sediment into waters of the state to catastrophic effects associated with mass failures of road fill material during large storms. Roads can affect geomorphic processes primarily by: accelerating erosion from the road surface and prism itself through mass failures and surface erosion processes; directly affecting stream channel structure and geometry; altering surface flow paths, leading to diversion or extension of channels onto previously unchanneled portions of the landscape; and causing interactions among water, sediment, and debris at road-stream crossings. The operator's proposed crown and ditched access road has minimal cuts/fills across relatively flat terrain. The operator is responsible for having the construction of the road meet Bureau standards. The road should be completed, including any culverts, cattleguards and required surfacing, before the drilling rig or other drilling equipment moves onto the pad in order to protect erodible soils.

Operator propose to use a seed mix on privately owned surface estate developed by the surface owners that is comprised primarily of grass species with the goals being to revegetate the area and provide forage opportunity for livestock. The seed mix does compliment the soil types and ecological sites found in the project area, and the mixing of soil horizons in disturbed areas. BLM has developed a seed mix to be used on the federal surface that complements the native plants species composition and richness associated with the site specific soil type. The BLM will evaluate reclamation success using the requirements in the BLM State Wide Reclamation Policy found at: <http://www.blm.gov/wy/st/en/programs/reclamation>.

4.2.2.2. Soils Susceptible to Erosion

Areas that are difficult to reclaim include drastically disturbed sites, steep slopes, sandy sites, and areas where the parent material is very shallow (typically less than 10 inches deep). Sandy sites and areas where the parent material is shallow were identified during initial site visits to the well sites. Approximately 5,100 feet of access road as well as the entire well pad are proposed over sandy soils that are highly susceptibility to water and wind erosion; a total of 10.4 acres of surface disturbance. The remaining 2,120 feet of access road is proposed over sandy loam soil. All access roads are to be crown and ditched to accommodate runoff and minimize soil erosion. Other important though less visible soil characteristics were identified in the project area using SSURGO Data, onsite investigation, and project design review, these are listed below.

- Predicted disturbance would impact soils by exposing material deep in the soil material, which may have chemical and physical properties contributing to limited reclamation potential (LRP) properties.
- Amount of bare ground, physical and chemical properties, and site conditions create sites classified as highly erosive to wind and water erosion.
- The proposed cut and fill slopes 2:1 (45%) and 1.5:1 (67%) will contribute to the erosion classification and exceed the 25% slope restriction.

During the construction and drilling phase of the project, the operator plans to maintain 2:1 cut slopes and fill slopes at 1.5H: 1V slopes. These slopes are very steep equivalent to 45% and 67% slope respectfully. These slopes are very challenging if not impractical to stabilize, and revegetate to meet the requirements of the Wyoming Reclamation Policy. These constructed slopes will be bare ground void of vegetation with the fill slopes being less stable due to soil mixing. Sediment transport from the surface disturbance areas is likely to be extensive even with proposed mitigation measures implemented.

The SUPO states production facilities will have cut and fill slopes reduced to 3V:1H (33% slope). These slopes exceed 25%. These slopes need to have mitigation applied to reduce the slope length to address erosion and stability issues. Highly erosive soils due to the loss of vegetation and the physical and chemical properties encountered make the site susceptible to wind erosion. Slope length and steepness are components in defining water erosion potential thus creating a highly erosive site to wind and water erosion. Modeled erosion amounts far exceeded the soil loss tolerance factor of the soils in the area, therefore expedient stabilization is required.

The reclamation plans developed by Carrizo and BLM applied COAs that would be implemented to mitigate or reduce the impacts associated with construction and operation. Interim reclamation consists of minimizing the footprint of disturbance by reclaiming all portions of construction disturbance not needed during production operations. Final reclamation would meet the guidelines outlined in the statewide reclamation policy. These actions would notably reduce intensity of the impacts to soils as well as the estimated time it would take to return the disturbed soils to a stable and productive state.

4.2.2.2.1. Reclamation Potential

The soil depth identified in the SSURGO data ranges from 32 to 60 inches deep (A and B Horizons) at the well location; an adequate depth to isolate or buffer the rooting zone from the C and Cr soil horizons that inhibit plant growth. The predicted cut depth exceeds the identified soil depth, thus impacting C and Cr horizons which are described as “little affected by pedogenic processes”, or unaltered parent material. The physical and chemical properties of the material is variable and very limiting in its potential to support plant growth, variable in erosion potential and suitability for construction material. During the construction process, the topsoil A Horizon will be stripped and the underlying soil horizons will be inverted and mixed; thus the exposure and creation of material described as Limited Reclamation Potential areas. During the construction process, this material is mixed and exposed to the surface creating an opportunity to contaminate surface soil. Even after the well pad is reduced during the production phase of the project, topsoil depth distributed over this parent material will be 10 inches or less; a shallowly buffered rooting zone. Suitable topsoil and subsoil material to an adequate depth is required to support desired vegetation.

The majority of the proposed access road to the Mooney Draw 1H, as well as the well pad, lies over the soils rated fair to poor as topsoil or reclamation source material.

4.2.2.2.1.1. Cumulative Effects

For details on expected cumulative impacts, refer to the PRB FEIS, pp. 4-151. The PRB FEIS defines the designation of the duration of disturbance (pp. 4-1 and 4-151). Most soil disturbances would be short term impacts (less than 2 years) with expedient interim reclamation and site stabilization. These impacts, singly or in combination, could increase the potential for valuable soil loss due to increased water and wind erosion, invasive/noxious/poisonous plant spread, invasion and establishment, and increased sedimentation and salt loads to the watershed system, if applicable mitigation measures are not used.

Geomorphic effects of roads and other surface disturbance range from chronic and long-term contributions of sediment into waters of the state to catastrophic effects associated with mass failures of road fill material during large storms. Roads can affect geomorphic processes primarily by: accelerating erosion from the road surface and prism itself through mass failures and surface erosion processes; directly affecting stream channel structure and geometry; altering surface flow paths, leading to diversion or extension of channels onto previously unchannelized portions of the landscape; and causing interactions among water, sediment, and debris at road-stream crossings.

4.2.2.2.1.2. Mitigation Measures

Carrizo will reduce impacts to vegetation and soils from surface disturbance by following its plans, using BLM applied mitigation, and the BLM Wyoming Reclamation Policy. These practices, as well as other mitigation measures identified in the SUPO and COAs, will result in less surface disturbance and overall environmental impacts. Carrizo will stabilize areas not needed for production during and within 30 days after construction is initiated. For safety of travel, to reduce rutting and increase traction, Carrizo will place a minimum average of 4 inches of crushed rock across the roadway. To protect erodible soils, all road construction should be completed, including any culverts, cattleguards, and required surfacing, before the drilling rig or other drilling equipment moves to the pad. Carrizo will ensure that the construction of the road meets the design criteria and BLM standards. Carrizo will provide erosion control

along all cut and fill slopes to maintain soil stability and achieve successful reclamation. Erosion control features include water bars, mulching, straw crimping, or erosion blankets, etc. Carrizo will provide for construction oversight of the well pad.

Straw/Excelsior wattles are most effective as erosion control if applied on slopes less than 3H:1V. In the absence of manufacture's specifications included in the operator's SUPO, the minimum spacing requirements will be as follows:

Slope	6-inch waddle	9-inch waddle	12-inch waddle
<4H:1V	20 feet	40 feet	60 feet
3H:1V	15 feet	30 feet	45 feet
2H:1V	10 feet	20 feet	30 feet
1H:1V	5 feet	10 feet	15 feet

Topsoil stored for a period greater than 90 days will not exceed piles of 10 feet in depth and will be seeded with the BLM-approved seed mix to prevent wind and water erosion.

The well pad cut and fill slopes at the 2V:1H or steeper constructed slopes are features that exhibit severe erosion potential that will require disturbed areas to be stabilized (stabilization efforts may include mulching, matting, soil amendments, et. cetera) in a manner which eliminates accelerated erosion and stabilizes the site in accordance with the Wyoming Reclamation Policy. Stabilization efforts shall be finished within 30 days of the initiation of construction activities. This applies to all surface disturbances within the Mooney Draw 1H well pad area. The appropriate mitigation measures using BLM applied mitigation to reduce impacts to vegetation and soils from surface disturbance are well described in the Barlow Ranch Federal 074974-3NH, WY-070-EA12-173, incorporated here by reference, as well as the BLM Wyoming Reclamation Policy. These practices, as well as other mitigation measures identified in the SUPO and COAs, will results in less surface disturbance and overall environmental impacts. Refer also to the parameters found in the PRB RMP FEIS ROD to prevent unnecessary and undue degradation (p. 11-12, A-19 to A-20, A-24, A-31), Onshore Oil and Gas Order #1, IV.C, and the Wyoming BLM Reclamation Policy to avoid highly erodible areas or mitigate effects.

4.2.2.2.1.3. Production Pad

At the time of interim reclamation, all topsoil will re-spread across the reduced cut and fill slopes; there is to be no long-term topsoil storage.

Erosion control fabric used for reclamation of steep slopes should be photodegradable or biodegradable. Non-photodegradable/biodegradable erosion control fabric will be removed from the federal leases following establishment of a self-perpetuating native plant community and sustained soil stability.

In the absence of manufacture's specifications included in the operator's SUPO, erosion control fabric will be installed as follows:

- The fabric will be 'keyed' into the slope by digging a small trench at the top of the slope;
- Lay the top end of the material into the trench to line it;
- To line it the edge is folded underneath itself and then it is secured using staples;
- The trench is then filled in to the previous soil level; and
- Fabric should be overlapped no less than 1 foot on edges and stapled on 3 foot spacing and at every seam.

Stabilization of steep slopes greater than 4H:1V will include but is not limited to the following components to minimize soil erosion and loss of seed:

- Surface roughening/pocking or scarification perpendicular to the slope;

- b. Install slope breakers such as waddles and water bars at the appropriate spacing;
- c. Seed with appropriate seed mix; and
- d. Apply straw mulch or bio/photodegradable erosion control fabric on highly erodible soils.

4.2.2.2.1.4. Residual Effects

Residual effects across the project would include a long-term loss of soil productivity associated with well pads and roads. The PRB FEIS identified residual effects (p. 4-408) such as the loss of vegetative cover, despite expedient reclamation, for several years until reclamation is successfully established. In spite of the above residual effects, the BLM considers that Alternative B with is within the parameters for surface disturbance and surface disturbance reclamation in PRB FEIS ROD.

4.2.3. Ecological Sites and Vegetation

4.2.3.1. Direct and Indirect Effects

The PRB FEIS discusses most direct and indirect effects to ecological sites and vegetation, p. 4-153 to 4-164. The proposed action would impact the common plant communities that occur on the site and the transition between the communities.

Other impacts anticipated to occur include those in the direct and indirect effects listed above under soils section. Direct effects to ecological sites would occur from ground disturbance caused by construction of well pads, ancillary facilities, associated pipelines, and roads. Short term effects would occur where vegetated areas are disturbed but later reclaimed within 1 to 3 years of the initial disturbance. Long-term effects would occur where well pads, compressor stations, roads, water-handling facilities or other semi-permanent facilities would result in loss of vegetation and prevent reclamation for the life of the project.

Sagebrush does not regenerate easily after human disturbance such as urban or agricultural development, or even after natural occurrences such as wildfire. It takes years, even generations, for sagebrush to fully grow back. Sagebrush still has not returned to some areas of the Columbia Basin burned by a large fire 40 years ago (Pacific Northwest National Laboratory Shrub Steppe Ecology Series May 2010).

Soil impacted by the road and well location in the project area is susceptible to wind and water erosion especially once stripped of vegetation. This is primarily due to the low annual precipitation, low organic matter content, physical and chemical properties of the soils in the area. Soils are either well drained or excessively drained which results in low water holding capacity, and low potential for restoration. These properties create unstable soils and physical and chemical properties that limit plant growth along the access routes. The project area has fragile topsoil with fragile root systems used to stabilize the surface and allow plant growth. Authorizations for surface disturbing actions are based upon the assumptions that a disturbance can ultimately be successfully reclaimed.

4.2.3.2. Cumulative Effects

The PRB FEIS discusses the cumulative effects to ecological sites, pp. 4-153 to 4-172. Cumulative effects to ecological sites include the further alteration of disturbance regimes from the increased disturbance, increase in noxious weeds, and alterations in vegetation community's diversity and cover.

4.2.3.3. Mitigation Measures

Implementation of the soils COAs and mitigation measures listed above the operator's Integrated Weed and Pest Management Plan and the BLM listed in the SUPO (specifically Plans for Reclamation of the Surface) will reduce surface disturbance impacts to ecological sites and vegetation. See the administrative record for some of these documents. BLM selected seed mixes which contain native grasses and forbs could restore disturbed areas to properly functioning vegetation communities with the exception of sagebrush since it's not in the current seed mixes. BLM offers the same protections to privately owned surfaces that are disturbed as a result of federal mineral development as those administered by the BLM

and therefore BLM developed a site specific seed mix for the well pad and access road for the proposed project. The company will apply these mitigation measures to the disturbance area which will require expedient reclamation. The surface owner may choose a seed mix that may be more beneficial for grazing. The Operator submitted a reclamation plan prepared by Grouse Mountain Environmental Consultants who recommends follow up monitoring of the drastically altered conditions and utilizing modern technologies adapted as appropriate to accomplish reclamation goals.

A 30 day stabilization requirement is applied to all cut and fill slopes of the well pad and access road which will have impacts to sensitive areas identified in the field. If applied correctly, the seed mix which contains native grasses, in addition to residual seed from forbs, and shrubs could restore disturbed areas to properly functioning vegetation communities. The private landowner has chosen a seed mix only grass species that is more beneficial to ranch operations. See mitigation section in the soils section above for a full description of the policy as it applies equally to ecological sites.

4.2.3.4. Residual Effects

Residual effects were also identified in the PRB FEIS, p. 4-408 such as the loss of vegetative cover, despite expedient reclamation, for several years until reclamation is successfully established. The alteration of biodiversity of ecological sites could result from disturbance, alterations in vegetation in reclaimed areas, and the spread and establishment of weed species. The production portion of the well pad and the access roads will present a long term challenge for BLM and the Operator to stabilize; interim reclamation which should create a stable functioning ecosystem that prepares the site for eventual final reclamation according to guidance provided in the Wyoming Reclamation Policy.

Failure to successfully implement the Wyoming Reclamation Policy will likely result in long term wind and water erosion to soils with little or no re-vegetation success. The BLM considers these residual effects from Alternative B with the proposed well are within the parameters for acceptable surface disturbance and its reclamation in the PRB FEIS ROD and Onshore Oil and Gas Order Number 1.

4.2.4. Water Resources

Adherence to the drilling COAs, the setting of casing at appropriate depths, following safe remedial procedures in the event of casing failure, and using proper cementing procedures should protect fresh water aquifers above the drilling target zone. Compliance with the drilling and completion plans and Onshore Oil and Gas Orders Nos. 2 and 7 minimize an adverse impact on ground water.

4.2.4.1. Groundwater

4.2.4.1.1. Direct and Indirect Effects

With applied mitigation measures there are no reasonable/foreseeable direct/indirect/cumulative or residual effects with the drilling of the proposed wells. Additionally the cumulative industry and regulatory experience shows that thousands of wells pierce the nation's largest aquifer in western Texas, Oklahoma, and Kansas with essentially no direct or indirect impact to that groundwater, see generally, <http://www.spe.org/jpt/print/archives/2010/12/10Hydraulic.pdf>. Lastly, the EPA 2004 study and its ongoing, detailed study of hydraulic fracturing yielded no immediate cautions, concerns, or warnings that present industry and regulatory practices endanger ground water or require immediate changes.

The Fox Hills, the deepest penetrated fresh water zone in the PRB, is between 5,221 to 5,295 feet below the Mooney Draw 1H location. This is well above the target Muddy Formation. Table 4.1 shows the depths where casing will be set and cemented in place. The operator will verify that there is competent cement across the aquifer, from 100 feet above to 100 feet below the Fox Hills Formation. Wyoming State Engineer's Office well log records of the 1 existing stock water wells within 1 mile of the proposed wells and the nearest CBNG well (680 feet to the East) indicate that the top of the ground water table is at

least 500 feet. New casing properly cemented in place and verified by a cement bond log will ensure that ground water will not be adversely impacted by well drilling and completion operations.

Table 4.1. Casing Set and Cementing Depths in relation to the Fox Hills

Well Name/ #	Depth of Surface Casing	Depth of Intermediate Casing	Depth to Fox Hills
Mooney Draw 1H	0-1,900 feet	9,645 feet	5,221 to 5,295feet

Consumption of substantial quantities of ground water being used for HF ranging from 40,000 to 80,000 bbls has raised concern especially of stock growers in the region.

4.2.4.1.2. Cumulative Effects

The volume of water produced by this federal mineral development is unknowable at the time of permitting. Carrizo will have to produce a well for a time to be able to estimate the volume and quantity of water production. To comply with Onshore Order Oil and Gas Order No. 7 Disposal of Produced Water, Carrizo will submit a Sundry to the BLM within 90 days of a wells first production which includes a representative water analysis and the final proposal for water management. The quality of water produced in association with conventional oil and gas historically was such that surface discharge would not be possible without treatment. Initial water production is quite low in most cases. There are 2 alternatives for water management: deep disposal via re-injection or disposal into evaporation pits. Both alternatives are protective of groundwater resources when performed in compliance with state and federal regulations.

4.2.4.1.3. Mitigation Measures

Adherence to the drilling COAs, the setting of casing at appropriate depths, following safe remedial procedures in the event of casing failure, and utilizing proper cementing procedures should protect fresh water aquifers above the target coal zone. Adherence to WDEQ permits and regulations will also mitigate impacts from produced water. This will ensure that groundwater will not be adversely impacted by well drilling and completion operations.

4.2.4.1.4. Residual Effects

Residual effects anticipated include the drawdown of ground water from the substantial demand for water associated with hydraulic fracturing process making that same water source unavailable for other future uses. Concern for the potential of ground water contamination has prompted BLM to develop policy for a process to disclose to the public the chemicals used for the drilling and HF of oil and gas wells.

4.2.4.2. Surface Water

4.2.4.2.1. Direct and Indirect Effects

Carrizo prefers to use an open drilling pit system, however BLM's preference is that closed loop drilling system be used consistent with Instruction Memorandum No. WY-2012-007. A closed loop drilling system would avoid possible contamination from an open reserve pit/drilling mud system. A closed loop drilling system would avoid possible contamination from an open reserve pit/drilling mud system. This project should not effect any springs as none are known in the area; the 7 stock water reservoirs likely charge through active seeps with surface flow downstream. A WYPDES non-point source permit for construction activities would address potential surface water impacts from storm water runoff. The well location will be incorporated into Carrizo's discharge stormwater permit associated with large construction activities as required by WYDEQ.

4.2.4.2.2. Cumulative Effects

Refer to the PRB FEIS, p. 4-115 to 4-117 and Table 4-13 for cumulative effects relative to the watershed and p. 117 for cumulative effects common to all sub-watersheds. The designation of the duration of disturbance is defined in the PRB FEIS, pp. 4-1 and 4-151. Most soil disturbances would be short term impacts with expedient interim reclamation and site stabilization.

4.2.4.2.3. Mitigation Measures

Adherence to the drilling plan, Onshore Order #7, SUPO, COAs, and WYPDES permit will minimize surface water impacts.

4.2.4.2.4. Residual Effects

Residual effects include those associated with reduced surface water quality due to loss of vegetation and increased erosion and sediment flow from construction sites.

4.2.5. Wetland/Riparian

Carrizo's proposal, with properly applied mitigation, should not adversely impact watershed values, including natural drainages. There is little to no evidence the proposal will adversely impact other water resources, however, there is the potential that gas and or oil pipelines constructed by '3rd party' operators could directly impact wetlands. Watershed values, including natural drainages, would not be unduly impacted by the proposal with properly applied mitigation. Other water resources will not be adversely impacted by the proposal. Possible contamination effects of fresh water aquifers will be reduced through the use of tested casing, by setting casing at appropriate depths and by following safe repair procedures in the event of casing failure. Other downhole well operations are expected to cause minimal impacts using standard engineering practices. The cumulative impacts of the proposed action, when considered with other existing and proposed development in the project area are not expected to be significant. The application of mitigation measures will ensure that the incremental impacts of this well, when considered with any existing development are insignificant. For more information on cumulative impacts, please refer to the PRB FEIS.

4.2.5.1. Cumulative Effects

Cumulative effects to wetland/riparian areas from oil and gas development are discussed in the PRB FEIS, pp. 4 178 and 4-179. Proposed surface disturbances would result in temporary, construction-related impacts to wetlands which would be reclaimed through interim reclamation and site stabilization, as committed to by the operator and as required by the BLM in COAs.

4.2.5.2. Mitigation Measures

No crossings of wetland/riparian areas by linear features, such as pipelines, roads, and power lines are proposed. The lower edge of soil or other material stockpiles will be outside the active flood plain.

4.2.5.3. Residual Effects

Turbidity and sediment loading in the streams would probably increase due to erosion of project disturbed areas and sediment transport to the associated drainages due to storm water runoff. These impacts are mitigated by expediently stabilizing the disturbance and reducing the sediment reaching the streams.

4.2.6. Invasive Species

4.2.6.1. Direct and Indirect Effects

The Operator committed to the control of noxious weeds and species of concern using the following measures identified in their Integrated Pest Management Plan (IPMP): 1) control methods, including frequency, 2) preventive practices, and 3) education. Cheatgrass or downy brome (*Bromus tectorum*) and to a lesser extent, Japanese brome (*B. japonicus*) exist in the affected environment. These species are found in such high densities throughout NE Wyoming that a control program is not presently feasible.

The use of existing facilities along with the surface disturbance associated with construction of proposed access roads, pipelines, and related facilities would present opportunities for weed invasion and spread. The activities related to the performance of the proposed project would create a favorable environment for the establishment and spread of noxious weeds/invasive plants such as Canada thistle, spotted knapweed and buffalo burr. However, expedient reclamation and other mitigation as required by BLM applied COAs will reduce potential impacts from noxious weeds and invasive plants.

4.2.6.2. Cumulative Effects

Cumulative effects resulting from noxious and invasive weed species are discussed in the PRB FEIS, p. 4-171. Species of concern identified in the IPMP, include the following: Dalmatian toadflax, common tanzy, Canada thistle, and spotted knapweed.

4.2.6.3. Mitigation Measures

Successful reclamation through application of the operator's reclamation plans will discourage establishment of invasive species during operations. In addition, measures incorporated into the programmatic COAs listed in the COA document will further mitigate the potential spread and establishment of weed species. The operator will be responsible for prevention and control of noxious weeds and weeds of concern on all areas of surface disturbance associated with this project (well locations, roads, water management facilities, etc.). Use of pesticides shall comply with the applicable federal and state laws. Pesticides shall be used only in accordance with their registered uses and within limitations imposed by the Secretary of Interior. Prior to the use of pesticides on public land, the holder shall obtain from the BLM authorized officer written approval of a plan showing the type and quantity of material to be used, pests to be controlled, method of application, location of storage and disposal of containers, and any other information deemed necessary by the authorized officer to such use.

Phased reclamation plans will be submitted to BLM for approval prior to individual well abandonment via a Notice of Intent (NOI) Sundry Notice. Individual facilities, such as well location and road need to be addressed in these plans as they are no longer needed. Individual items that will need to be addressed in reclamation plans include:

- Cuttings Pit closure (Close ASAP after suitably dry, but no later than 180 days from time of drilling unless an extension is given by BLM Authorized Officer.)
- Configuration of reshaped topography, drainage systems, and other surface manipulations
- Waste disposal
- Revegetation methods, including specific seed mix (pounds pure live seed/acre) and soil treatments (seedbed preparation, fertilization, mulching, etc.). On private surface, the landowner should be consulted for the specific seed mix.
- Other practices that will be used to reclaim and stabilize all disturbed areas, such as water bars, erosion fabric, hydro-mulching, etc.
- An estimate of the timetables for beginning and completing various reclamation operations relative to weather and local land uses.
- Methods and measures that will be used to control noxious weeds, addressing both ingress and egress to the individual well.
- Decommissioning/removal of all surface facilities
- Any mulch utilized for reclamation needs to be certified weed free.

Based on the implementation of the COAs, and the measures outlined within the SUPO and its associated plans including the IPMP and Reclamation Plan, no additional mitigation measures are recommended.

4.2.6.4. Residual Effects

Control efforts by the Operator would be limited to the surface disturbance associated the construction and operation of the project. Cheatgrass and other weed species that are present within non-physically

disturbed areas of the project area are anticipated to continue to spread unless control efforts are expanded. Cheatgrass and to a lesser extent, Japanese brome (*Bromus japonicus*) are found in high densities and numerous locations throughout northeast Wyoming. Efforts are being made by BLM, USDA, WGFD and other partners at some small infestation areas are being treated but for the most part, control programs are not considered feasible at this time and these annual bromes will continue to be found within the project area.

4.2.7. Fish and Wildlife

4.2.7.1. Big Game

4.2.7.1.1. Direct and Indirect Effects

The PRB FEIS analyzed impacts to big game, pp. 4-181 to 4-210. As discussed in that document, impacts to mule deer may occur through alterations in hunting and/or poaching, increased vehicle collisions, harassment and displacement, increased noise, increased dust, alterations in nutritional status and reproductive success, increased fragmentation, loss or degradation of habitats, reduction in habitat effectiveness, and declines in populations. The current populations for pronghorn, white-tailed deer, and mule deer are above, above, and below WGFD goals, respectively.

4.2.7.1.2. Cumulative Effects

The cumulative effects associated with Alternative B, are within the analysis parameters and impacts described in the PRB FEIS. Refer to the PRB FEIS, pp. 4-181 to 4-215, for details on expected cumulative impacts.

4.2.7.1.3. Mitigation Measures

BLM proposes no mitigation with Alternative B.

4.2.7.1.4. Residual Effects

The incorporated design features and mitigation will not eliminate all project effects. Irretrievable impacts are listed in the PRB-EIS p. 4-408 that include loss of wildlife habitats beyond the life of the project, depending on the success of reclamation and decreased wildlife populations. Habitat effectiveness, nutrition status, and reproductive success of big game species would decrease (PRB-EIS, p. 4-406).

4.2.7.2. Raptors

4.2.7.2.1. Direct and Indirect Effects

Direct and indirect impacts to raptors, from oil and gas development, are analyzed in the PRB FEIS, pp. 4-216 to 4-221. No direct impacts to raptor nests are anticipated from the project. However, indirect impacts may occur as a result of project activities. This project will result in disturbance in proximity of nesting raptors, including direct loss of foraging habitats and indirect losses associated with declines in habitat effectiveness. There are 18 known raptor nests within 0.5 miles of project components and suitable nesting habitat is present throughout the project area. To reduce the risk of decreased productivity or nest failure, the BFO requires a 0.5-mile radius timing limitation during the breeding season around active raptor nests and recommends all infrastructures requiring human visitation be sited to provide adequate biologic buffer for nesting raptors. A biologic buffer is a combination of distance and visual screening that provides nesting raptors with security such that they will not be flushed by routine activities. Construction, drilling and production could deter raptors from selecting a nest site in the vicinity of the new well location. If Carrizo would voluntarily restrict well site visits and work-over operations at the well location during the raptor breeding season, raptors may not avoid selecting the area for nesting. The operator did not volunteer any such mitigation and such a measure is more restrictive than BLM-BFO land use plans provide. Additional direct and indirect impacts to raptors, from oil and gas development, are analyzed in the PRB FEIS, pp. 4-216 to 4-221.

4.2.7.2.2. Cumulative Effects

It is likely that impacts to raptors will be greater than those analyzed in this EA as Carrizo has not included plans for pipeline to the well location to gather produced oil and/or gas. The pipeline(s) would likely be constructed by a “third party” and not Carrizo so it is uncertain where those powerlines will actually fall on the landscape - making it impossible at this time to adequately analyze the impacts of and pipeline construction. Dependent on how productive the well is will dictate the number of tanker trucks at the site each day and the level of disruptive activity raptors in the vicinity will endure. The cumulative effects associated with Alternatives B are within the analysis parameters and impacts described in the PRB FEIS, p. 4-221.

4.2.7.2.3. Mitigation Measures

Measures intended to avoid, minimize, and mitigate impacts to raptors are outlined in the COA documents, including operator committed measures and site-specific COAs. For example, to reduce the risk of adverse impacts to nesting raptors, no surface-disturbing activity will occur prior to surveys to document nest occupancy shall be conducted by a biologist following BLM protocol, between April 15 and June 30. All survey results shall be submitted in writing to a Buffalo BLM biologist and approved prior to surface-disturbing activities. Surveys outside this window may not depict nesting activity. If a survey identifies active raptor nests, a 0.5 mile timing buffer will be implemented. The timing buffer restricts surface-disturbing activities within 0.5 mile of occupied raptor nests from February 1 to July 31. This timing limitation will affect surface disturbing activities within the SESW Section 23 and NENE Section 25, T52N/R75W; SWNW and NESW Section 30, T52N/R74W.

4.2.7.2.4. Residual Impacts

There would be an increase in traffic, construction activity, and human presence in the area over the life of the project that would affect the quality of the area for nesting raptors. Disturbance to nesting raptors can cause nest failure, nest abandonment, and unsuccessful fledging of young (PRB FEIS, p. 4-218). Timing limitations would protect nests from disturbance during the construction phase of the project. Timing limitations will not apply during well completion operations, well monitoring, oil trucks and maintenance activities; those activities would possibly discourage raptors from using nest locations or abandon the nest if a pair had initiated nesting prior to such disruptive activities occurring.

4.2.7.3. Plains Sharp-tailed Grouse

4.2.7.3.1. Direct and Indirect Effects

Direct and indirect effects to sharp-tailed grouse are described in the PRB FEIS pp. 4-221 to 4-226 and expected are similar to those effects to GSG described below. Sharp-tailed grouse may avoid habitats adjacent to the project area. Wildlife Resources reported 3 sharp-tail leks in the vicinity of the project area. The nearest lek is 0.42 miles southeast (SWNW Section 30, T52N/R74W) of the Mooney Draw 1H and is expected to be impacted from the human disruption. Another sharp-tailed lek is 0.25 miles north of the existing access road to be improved. Impacts to the sharp-tailed grouse lek in Section 24, T52N/R75W will result from increased average daily traffic during the drilling and construction activities. Construction and maintenance activities associated with development of the proposed project will cause direct habitat loss and fragmentation.

4.2.7.3.2. Cumulative Effects

The PRB FEIS described the cumulative effects to sharp-tailed grouse, pp. 4-221 to 4-226.

4.2.7.3.3. Mitigation Measures

The BLM would apply a timing limitation during the breeding season to protect sharp-tailed grouse that use the area for nesting and breeding. No surface disturbing activity shall occur within 0.64 miles of the sharp-tailed grouse lek from April 1 – June 15, annually, prior to a survey to determine activity at the lek.

This timing limitation affects surface disturbing activities located in SE Section 30 T52N R74W including the access road and well pad.

4.2.7.3.4. Residual Impacts

A timing limitation does not mitigate loss and fragmentation of habitat. Suitability of the project area for sharp-tailed grouse would be negatively affected due to habitat loss and fragmentation and proximity of human activities associated with energy development.

4.2.7.4. Migratory Birds

4.2.7.4.1. Direct and Indirect Effects

The PRB FEIS discussed direct and indirect effects to migratory birds, pp. 4-231 to 4-235. The direct and indirect effects to migratory birds associated with this project are similar to those analyzed in the Sahara POD EA pp. 31-33, incorporated here by reference. The BLM identified suitable nesting habitat for several BLM sensitive sagebrush obligates is present at the well site. The habitat at the well location and along the proposed access road includes sagebrush steppe community. Vegetative cover ranges between 50% along the access route and 75% at the well site even though the area has had of long-term, intense grazing operations. Migratory bird species in the PRB nest in the spring and summer and are vulnerable to the same effects as GSG and raptor species. Though no timing restrictions are typically applied specifically to protect migratory bird breeding or nesting, where GSG or raptor nesting timing limitations are applied, nesting migratory birds are also protected. Where these timing limitations are not applied and migratory bird species are nesting, migratory birds are vulnerable. Surface disturbing activities associated with construction of the well access road will have GSG and raptor timing limitations applied, thereby providing some protection to migratory birds.

Carrizo proposes using a heater treater during the production phase of the project. Heater treaters, and similar facilities, having vertical open-topped stacks or pipes can attract birds. Those facilities without exclusionary devices can pose a mortality risk. Once birds crawl into the stack, escape can become difficult and the bird may become trapped (U.S. v. Apollo Energies Inc., 611 F.3d 679 (10th Cir. 2010); see also, Colorado Oil and Gas Commission, Migratory Bird Policy, accessed February 13, 2012). The use an open reserve pit system will increase the potential impacts to the migratory birds that may become trapped in an open drilling/reserved pit or exposed to hazardous vapors from drilling fluids.

4.2.7.4.2. Cumulative Effects

The cumulative effects associated with Alternative B, are within the analysis parameters and impacts described in the PRB FEIS. For details on expected cumulative impacts, refer to the PRB FEIS, p. 4-235.

4.2.7.4.3. Mitigation Measures

BLM proposes a timing limitation on surface disturbing activities for migratory birds. The timing limitation will apply to vegetation removal at the Moony Draw 1H well pad, access road, and infrastructure. Carrizo made no specific commitments to exclude birds from exhaust stacks (particularly with a circumference of greater than 2 inches), pits, ponds, and open-topped tanks, and other facilities that pose a threat. Thus, BLM will apply a COA to ensure that migratory birds are excluded from facilities that pose a mortality risk, including, but not limited to, reserve pit, heater treaters, flare stacks, and secondary containment where escape may be difficult or hydrocarbons or toxic substances are present.

4.2.7.4.4. Residual Effects

If any migratory bird species would nest in the area that construction would occur, individuals that are, may have nests destroyed, or be disturbed, by construction activities. Disruption from construction activities may also cause abandonment of active nests. If Carrizo does not properly maintain all exclusionary devices implemented for the project, birds may remain at risk of direct mortality.

4.2.7.5. Threatened, Endangered, Candidate, Special Status (Sensitive) Species

BLM summarized the effects to threatened, endangered, and candidate species in Table 4.3, below and described them in the PRB FEIS, pp. 4-250 to 4-257.

Table 4.3. Summary of Threatened and Endangered Species Habitat and Project Effects

Common Name	Habitat	Presence	Project Effects	Rationale
<i>Threatened</i>				
Ute ladies'-tresses orchid	Riparian areas with permanent water	NP	NE	Habitat is not present. No known Ute ladies'-tresses orchid or seed source exists within the drainage.
<i>Candidate</i>				
Greater Sage-Grouse	Basin-prairie shrub, mountain-foothill shrub	K	WIPV	Suitable nesting and brood rearing habitat is present and the project will negatively affect GSG.
Presence K – Known, documented observation in project area. NS - Habitat suitable but species is not suspected to occur within the project area. NP - Habitat not present and species unlikely to occur within the project area.		Project Effects NE – No Effect WIPV - Will Impact Individuals or Habitat with a consequence that may contribute to a trend towards federal listing or cause a loss of viability to the population or species.		

4.2.7.5.1. Threatened and Endangered Species

4.2.7.5.1.1. Ute Ladies'-Tresses Orchid (ULT)

4.2.7.5.1.1.1. Direct and Indirect Effects

Suitable habitat is not present in the project area and there are no known populations of ULT in the Rough Draw or Twentymile Creek drainages. Implementation of the proposed project would not affect the ULT.

4.2.7.5.1.1.2. Cumulative Effects

The PRB FEIS discussed the cumulative effects to ULT, pp. 4-253 to 4-254).

4.2.7.5.1.1.3. Mitigation Measures

BLM proposes no mitigation with Alternative B.

4.2.7.5.1.1.4. Residual Effects

BLM anticipates no residual effects.

4.2.7.5.2. Candidate Species

4.2.7.5.2.1. Greater Sage-Grouse (GSG)

4.2.7.5.2.1.1. Direct and Indirect Effects

The 2010 FWS listing decision discussed impacts to GSG associated with energy development in detail. Impacts to GSG are generally a result of loss and fragmentation of sagebrush habitats associated with roads and infrastructure. Research indicates that yearling GSG hens also avoid nesting in developed areas, while older hens will continue nesting attempts in impacted habitats (Lyon and Anderson 2003, Holloran 2005, Holloran et al. 2010, FWS 2010). The proposed access road to the Mooney Draw well location is located within 2 miles of 1 occupied GSG lek, the Twentymile lek. The well location and the access road are located within habitat modeled and mapped as suitable nesting and brood rearing. Construction of the well pad and access road will result in a direct loss of GSG habitat. For a specific breakdown of proposed disturbance see Table 2.2. Alternative B. Implementation of the project will adversely impact nesting habitat, both through direct loss and avoidance of the area by GSG.

4.2.7.5.2.1.2. Cumulative Effects

There are 12,505 wells according to the WOGCC database, May19, 2014 (3,966 are abandoned) in the cumulative impact assessment area, an area of 1,498 square miles, which amounts to a density of approximately 8.3 wells per square mile. Currently, there are 34 proposed wells (WOGCC, May 19, 2014) (including the 1 from this project) within 12.4 miles of the 22 GSG leks. With the addition of the proposed wells, the well density within 12.4 miles of the leks would increase to 8.4 wells per square mile, over 7 times the 1 well per square mile recommendation made by the State Wildlife Agencies' Ad Hoc Committee for Sage-Grouse and Oil and Gas Development. Table 4.4, below, shows the well density within the 12.4 mile analysis area. Table B1, in Appendix B, further describes well density at 12.4 miles by individual lek.

Table 4.4. Well Density within the 12.4 Mile Impact Area

Analysis Area	Area mi²	# of Existing & Approved Wells	Well Density (Existing)	Proposed Wells	Well Density (including proposed)
buffer of leks within 12.4 miles of the 1 well	1,498	12,505	8.3 wells/mi ²	34	8.4 wells/mi ²

The cumulative effects to migratory birds associated with this project are similar to those analyzed in the Sahara POD EA pp. 34-37, incorporated here by reference.

4.2.7.5.2.1.3. Mitigation Measures

In order to reduce the impacts to GSG associated with noise, construction, and human disturbance resulting from implementation of the proposed project, BLM will consider a timing limitation (March 15- June 30) on surface-disturbing activities to maintain connectivity between GSG leks surrounding the new well and access road. The BLM agreed to implement the State of Wyoming's Sage-grouse Core Area Strategy (IM 2012-019); which protects approximately 80% of GSG leks in the State. However in the PRB approximately 20% of leks are in core designated habitats, and the shape and size of the Buffalo priority habitats limits the protections afforded these leks. Additional mitigation may be necessary to maintain populations in the PRB. Such mitigation could include; increasing WNV control efforts, avoiding/minimizing surface water discharges, enhancing priority habitat quality, accelerating the pace of development by modifying or eliminating timing restrictions in some areas, efficiently suspending leases in (or habitats supporting) core, identifying areas in core, or undeveloped areas adjacent to core, that are appropriate for off-site mitigation, reducing supplemental predator habitat, and increased reclamation.

Aggressive reclamation of plugged and abandoned well fields, combined with habitat enhancements in functional core and supporting areas, may provide a population of birds to re-populate areas that can be successfully reclaimed. GSG habitat restoration efforts in the PRB are ongoing. The BLM identified historical GSG population centers that are ready for oil and gas reclamation where stakeholders will apply enhanced reclamation techniques. The intent is maintaining and enhancing those areas with remaining GSG and increase suitability of currently uninhabited areas that are important for connectivity. The WY BLM initiated the PRB Restoration Program to implement strategies for accelerated reclamation and GSG habitat restoration in areas affected by federal oil and gas developments. BLM proposes timing limitations March 15- June 30 annually on surface disturbing activities to minimize impacts to GSG within 2-miles of occupied GSG leks. This timing limitation will affect construction activities in SESW and SE Section 23, S2 section 24 and NENE Section 25, T52N/R75W; W2 Section 30, T52N/R74W.

4.2.7.5.2.1.4. Residual Effects

The PRB FEIS predicted that the PRB oil and gas development would have significant impacts to the GSG population. The impact of the this 1 oil well development cumulatively contributes to the potential for local GSG extirpation yet its effect is acceptable because it is outside priority habitats and is within the

parameters of the PRB FEIS/ROD and current BLM and Wyoming GSG conservation strategies. Current research does not identify specific components of energy development that BLM or operators can alter to measurably decrease impacts to GSG or functionality of their habitats. Even in areas where BLM applied a variety of mitigation measures, negative population impacts are still measurable when well density exceeds approximately 1 well per square mile. Management of energy development based on current priority habitat configurations and associated lease stipulations, conditions of approval, and best management practices (BMPs), may not provide enough contiguous habitats sufficient to protect the remaining population viability of PRB GSG without a substantial investment in restoration. The PRB FEIS based its analysis and decision, in part, on the removal of all CBNG wells and most infrastructures at final well abandonment after the CBNG played out 10-15 years after drilling. In areas that are or were important to GSG, leaving infrastructure on the landscape may hamper restoration (Taylor et al. 2012).

4.2.7.5.3. Special Status (Sensitive) Species (SSS)

The PRB FEIS discusses impacts to sensitive species on pp. 4-257 to 4-265. BLM will take actions to meet the policies set forth in sensitive species policy (BLM Manual 6840). BLM Manual 6840.22A states that “The BLM should obtain and use the best available information deemed necessary to evaluate the status of special status species in areas affected by land use plans or other proposed actions and to develop sound conservation practices. Implementation-level planning should consider all site-specific methods and procedures which are needed to bring the species and their habitats to the condition under which the provisions of the ESA are not necessary, current listings under special status species categories are no longer necessary, and future listings under special status species categories would not be necessary.” The effects to sensitive species resulting from implementation of the project are in Table B-2 in Appendix B. Information regarding bald eagles is discussed below.

4.2.7.5.3.1. Bald Eagle

4.2.7.5.3.1.1. Direct and Indirect Effects

Impacts to bald eagles are discussed in the PRB FEIS, pp. 4-251 to 4-253. A study completed in 2004 suggests that two-tracks and improved project roads pose minimal collision risk to bald eagles. In 1 year of monitoring road-side carcasses, the BFO reported 439 carcasses, 226 along interstates (51%), 193 along paved highways (44%), 19 along gravel county roads (4%), and 1 along an improved CBNG road (less than 1%) (Bills 2004). No road-killed eagles were reported; bald and golden eagles were observed feeding on 16 of the reported road-side carcasses (less than 4%). The risk of big-game vehicle-related mortality along CBNG project roads is insignificant or discountable, when combined with the lack of bald eagle mortalities associated with highway foraging, leads to the conclusion that CBNG project roads do not affect bald eagles. No bald eagle nests or winter roosts were identified within 1 mile of the project area. Suitable habitat where roosting bald eagles have been observed exists northwest of the project area along Wild Horse Creek; the nearest roost is 16 miles west of the Mooney Draw 1H. The nearest recorded observation was a single adult perched on a hill top over 2 miles west of the proposed well location January 13, 2007. Implementation of the proposed project would not likely adversely impact bald eagle nesting or roosting due to the lack of suitable nesting and roosting structure available within a 1 mile of the well location but eagles would likely avoid the roosting on power poles within 1 mile of the well site during construction, drilling, and HF operations.

4.2.7.5.3.1.2. Cumulative Effects

The PRB FEIS discussed the cumulative effects for bald eagles, pp. 4-251 to 4-253.

4.2.7.5.3.1.3. Mitigation Measures

BLM proposes no mitigation.

4.2.7.5.3.1.4. Residual Effects

Even with timing limitations, habitat may be degraded to a point that the area no longer provides habitat requirements for wintering bald eagles. A 1.0 mile timing restriction on construction activities does nothing to protect valuable habitats from disturbance and also does not mitigate impacts associated with fee development.

4.2.7.5.3.2. Ferruginous Hawk

4.2.7.5.3.2.1. Direct and Indirect Effects

The PRB FEIS discusses impacts, including direct and indirect effects, to sensitive species on pp. 4-257 to 4-273. Additional impacts expected from project actions are described in the Raptor Section, above. Additionally, due to the territorial nature of ferruginous hawks, there is greater potential for disturbance to nesting ferruginous hawks. However, no active ferruginous hawk nests were identified during the past survey efforts by Wildlife Resources. There is suitable ferruginous hawk nesting habitat throughout the project area. Adverse impacts to this species are not anticipated.

4.2.7.5.3.2.2. Cumulative Effects

The PRB FEIS discusses impacts, including cumulative effects, to sensitive species on pp. 4-257 to 4-273.

4.2.7.5.3.2.3. Mitigation Measures

An annual survey will be required for nesting raptors and a TLS will apply (February 1 through July 31) if an active ferruginous hawk nest is located.

4.2.7.5.3.2.4. Residual Effects

Residual effects will be similar to residual effects of other raptors.

4.2.7.5.3.3. Brewer's Sparrow

4.2.7.5.3.3.1. Direct and Indirect Effects

The PRB FEIS discusses impacts to sensitive species on pp. 4-257 to 4-265. Additional impacts are described in the Migratory Birds section (Section 4).

4.2.7.5.3.3.2. Cumulative Effects

Cumulative impacts to sensitive species are discussed in the PRB FEIS on pp. 4-273.

4.2.7.5.3.3.3. Mitigation Measures

Raptor and GSG timing limitations on surface disturbing activities would also serve to mitigate some impacts to nesting Brewer's sparrows. To ensure compliance with the MBTA, the BLM recommends that pad construction occur outside of the migratory bird breeding season (May 1 – July 31). The BLM also recommends that measures are taken to ensure that migratory birds are excluded from all facilities that pose a mortality risk, including, but not limited to, heater treaters, flare stacks, and secondary containment where escape may be difficult or hydrocarbons or toxic substances are present.

4.2.7.5.3.3.4. Residual Effects

Timing limitations would apply to the entire project. If construction does not occur during May 1- July 31 it is unlikely that active nests will be destroyed by construction activities, as most nestlings will have already fledged. Nests initiated after the first week in July may be destroyed by construction after August 1st. Migratory birds nesting adjacent to the well pad or road may be disturbed by construction and production activities. A timing limitation does nothing to mitigate loss and fragmentation of habitat. Suitability of the project area for Brewer's sparrows will be negatively affected due to habitat loss and fragmentation and proximity of human activities associated with oil and gas development.

4.2.7.5.3.4. Northern Leopard Frog

4.2.7.5.3.4.1. Direct and Indirect Effects

The PRB FEIS discusses impacts to sensitive species on pp. 4-257 to 4-265.

4.2.7.5.3.4.2. Cumulative Effects

Cumulative impacts to sensitive species are discussed in the PRB FEIS on pp. 4-273.

4.2.7.5.3.4.3. Mitigation Measures

No mitigation is proposed with Alternative B.

4.2.7.5.3.4.4. Residual Effects

No residual impacts are anticipated.

4.2.7.5.3.5. Western Burrowing Owl

4.2.7.5.3.5.1. Direct and Indirect Effects

The PRB FEIS discusses impacts to sensitive species on pp. 4-257 to 4-273.

4.2.7.5.3.5.2. Cumulative Effects

The PRB FEIS discusses impacts to sensitive species on pp. 4-257 to 4-273. Practices such as poisoning or shooting of prairie dogs or other intentional methods of extermination can potentially affect burrowing owl productivity through a reduction in nest site availability.

4.2.7.5.3.5.3. Mitigation Measures

The Thunder Basin National Grasslands in Campbell County, WY, has a NEPA analysis recommending a 0.25 mile timing restriction buffer zone on surface disturbing activities for burrowing nest locations during their nesting season (April 15 to August 31). BLM will consider adopting this analysis since it is the same species in the same short grass – sagebrush prairie ecosystem. Instruction Memorandum No. 2006-197, directs the field offices to “use the least restrictive stipulations that effectively accomplish the resource objectives or uses.” Alteration of the general raptor nest timing limitation (Feb 1 to July 31) to a more specific burrowing owl nesting season timing limitation (April 15 to August 31) will effectively reduce the vulnerability of owls to collision while shortening the timing restriction period from six and one half months to four and one half months, and from 0.5 mile to 0.25 mile.

4.2.7.5.3.5.4. Residual Effects

Timing limitations do not mitigate habitat loss. Wells, pipelines, and roads that are built in prairie dog colonies would directly impact nesting habitat and may reduce the quality of adjacent habitats for burrowing owls, regardless of the timing of their construction.

4.2.8. Cultural Resources

4.2.8.1. Direct and Indirect Effects

BLM policy states that a decision maker’s first choice should be avoidance of historic properties (BLM Manual 8140.06(C)). If historic properties cannot be avoided, mitigation measures must be applied to resolve the adverse effect. Non eligible sites 48CA3070, 48CA5044, and 48CA5305 will be impacted by the proposed project. No historic properties will be impacted by the proposal. Following the State Protocol Between the Wyoming Bureau of Land Management State Director and The Wyoming State Historic Preservation Officer, Section VI(A)(1) the BLM notified the Wyoming State Historic Preservation Officer (SHPO) on April 14, 2014, that no historic properties exist in the area of potential effect (APE). If any cultural values (sites, features or artifacts) are observed during operation, they will be left intact and the Buffalo Field Manager notified. If human remains are noted, the procedures described in Appendix L of the PRB FEIS and ROD must be followed. Further discovery procedures are explained in Standard COA (General)(A)(1).

4.2.8.2. Cumulative Effects

Construction and development of oil and gas resources impacts cultural resources through ground disturbance, unauthorized collection, and visual intrusion of the setting of historic properties. This results in fewer archaeological resources available for study of past human life-ways, changes in human behavior through time, and interpreting the past to the public. Additionally, these impacts may compromise the aspects of integrity that make a historic property eligible for the National Register of Historic Places. Recording and archiving basic information about archaeological sites and the potential for subsurface cultural materials in the proposed project area serve to partially mitigate potential cumulative effects to cultural resources.

Fee actions constructed in support of federal actions can result in impacts to historic properties. Construction of large plans of coalbed natural gas development on split estate often include associated infrastructure that is not permitted through BLM. Project applicants may connect wells draining fee minerals, or previously constructed pipelines on fee surface with a federal plan of development. BLM has no authority over such development which can impact historic properties. BLM has the authority to modify or deny approval of federal undertakings on private surface, but that authority is limited to the extent of the federal approval. Historic properties on private surface belong to the surface owner and they are not obligated to preserve or protect them. The BLM may go to great lengths to protect a site on private surface from a federal undertaking, but the same site can be legally impacted by the landowner at any time. The cumulative effect of numerous federal approvals can result in impacts to historic properties. Archeological inventories reveal the location of sites and although the BLM goes to great lengths to protect site location data, information can potentially get into the wrong hands. BLM authorizations that result in new access can inadvertently lead to impacts to sites from increased visitation by the public.

4.2.8.3. Mitigation Measures

If operators observe any cultural values [sites, artifacts, human remains (Appendix L PRB FEIS and ROD)] during operation of this lease/permit/right-of-way, they will be left intact and the Buffalo Field Manager notified. Standard COA (General)(A)(1) further explains discovery procedures.

4.2.8.4. Residual Effects

During the construction phase, there will be numerous crews working across the project area using heavy construction equipment without the presence of archaeological monitors. Due to the extent of work and the surface disturbance caused by large vehicles, it is possible that unidentified cultural resources can be damaged by construction activities. The increased human presence associated with the construction phase can also lead to unauthorized collection of artifacts or vandalism of historic properties.

4.2.9. Transportation

4.2.9.1. Direct and Indirect Effects

The Carrizo proposes an additional 1.4 miles of proposed crown and ditch resource roads designed by Uintah Engineering and Land Surveying. The road is proposed with a minimum travel way surface of 16 feet. The design speed for the road is 20 mph with an average daily traffic (ADT) less than 20 trips per day however the ADT may be as high as 30 during drilling and completion operations. Dust may become a periodic driving visibility and human health issue. The crown and ditch road has a maximum grade of 8%. There is 1 existing gate that will be replaced with a cattle guard. Six culverts no less than 18 inches in diameter and additional cross drain culverts will be added as needed during construction. Culvert installation will follow the typical installation details provided in the engineered diagrams. Additional culverts and wing ditches may be needed in the life of the project and will be addressed via sundries.

Transportation in the project area would be affected on a long-term basis. The proposed development will increase the ADT on all of the existing roads in the project area for the duration of well production increasing maintenance needs. Well lifespan is anticipated to be 10 to 20 years. During this period both

the proposed and existing roads will have accelerated erosion and sedimentation, increased dust, dust abatement, higher noise levels, and additional traffic increasing accident potential. The roads will be used by the local ranchers, oil and gas personnel, federal government personnel, and to a lesser extent, the general public for recreational purposes. Long term impacts would be if the private land owners wish to keep the roads when the well is no longer in production for their ranching operation.

Vehicles have better traction with a road when the road surfacing material is compacted, creating a safer driving surface. Because clinker is a soft, non-durable, material, during compaction it breaks down into dust rather than being compacted. It typically lacks a distribution of particle sizes. Regular gravel without gradation parameters is a hard durable material but lacks the distribution of particle sizes required for compaction. Whereas gravel from crushed aggregate that is screened to meet Gradation W parameters (less than 1 inch), is a hard durable material that has a distribution of particle sizes that are designed to interlock when compacted - creating a solid driving surface. A solid driving surface also promotes sheet flow of surface run-off directing water away from the road; whereas clinker rock tends to promote infiltration into the road bed due to the porosity of burnt shale resulting in rutting and erosion. The benefit of keeping water off or away from the road is to reduce costs of maintenance. Although it is less suitable material for road surfacing, clinker rock is more readily available and less costly. There are fewer gravel sources and gravel is more costly due to the supply and demand and hauling fees.

4.2.9.2. Cumulative Effects

Conditions of existing roads in the area are highly variable. Roads generally are unpaved, and are constructed of native soils rated as marginal construction material. Mobilization of drilling and construction equipment relies on semi-trucks with trailers designed for use on paved roads and highways. The gross vehicle weight of these combination vehicles often exceeds 80,000 pounds with drilling rigs exceeding 100,000 pounds. There is concern that the use of these vehicles, especially when loaded, on roads not completely constructed may contribute to increasing a potential for motor-vehicle accidents.

4.2.9.3. Mitigation Measures

All constructed road segments will be completed, including any culverts, low water crossings and required surfacing, before the drilling rig or other drilling equipment moves onto the pad. Carrizo is responsible for having the licensed professional engineers certify that the actual construction of the road meets the design criteria and is constructed to Bureau standards; i.e. road surfacing material applied on federal lands will be crushed aggregate. BLM will apply a COA that requires the operator to provide for construction oversight of the road and well pad. In addition, the operator will be required to contact the BLM at least 4-days prior to construction to provide BLM the opportunity to complete onsite construction inspection. Carrizo may mitigate excessive dust with water, magnesium chloride or other treatments.

4.2.9.4. Residual Effects

Transportation use along the roads would be converted either for the duration of the well operation to primarily oil and gas use. During this timeframe, the road network would experience all weather use with an ADT of 2-20 vehicles. This is far in excess of seasonal fair-weather use of primitive roads used for livestock operations and recreational use. Additional traffic, risks of accidents, and indirect effects would be proportionate to the number of employees and activates for each year of the project. If roads are constructed as proposed, stabilized, and well maintained the residual effects associated with road high traffic us should be minimal.

5. CONSULTATION/COORDINATION

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